Consultancy Services for preparation of Two Stage Detailed Project Report (DPR) of National Waterway 96, Cluster-I: Subarnrekha River

FINAL FEASIBILTY REPORT

Inland Waterway Authority of India

Cluster – I : Subarnrekha River

Final Feasibility Report

Revision - 0

Nov 2016

Consultancy Services for preparation of Two Stage Detailed Project Report (DPR) of National Waterway 96, Cluster-I: Subarnrekha River

FINAL FEASIBILITY REPORT

Project **IWAI Cluster-I, Subarnrekha River**

Owner **IWAI, Ministry of Shipping**

Consultant **Egis India Consulting Engineers**

Authors **Project Team :** Team Leader + 7-Experts **Technical Manager:** Ashish Khullar **Project Manager:** Akshat Singhal			**Project No:** PT/EIPTIWB003 **Report No:** PT/EIPTIWB003/2016/FR/007 **Approved by:** Dr. Jitendra K. Panigrahi		
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ACKNOWLEDGEMENT

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*EIPL wishes to express their gratitude to **Cdr. P.K. Srivastava, Hydrographic Chief, IWAI** for his guidance and inspiration for this project. EIPL would also like to thank **Sh. Rajiv Singhal, A.H.S., IWAI** for their invaluable support and suggestions provided throughout the project duration. EIPL is pleased to place on record their sincere thanks to other staff and officers of IWAI for their excellent support and co-operation throughout the project duration.*

SALIENT FEATURES

<table>
<tr><th>S. No.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>1.</td><td>Name of Consultant</td><td>Egis India Consulting Engineers Pvt. Ltd.</td></tr>
<tr><td>2.</td><td>Cluster number</td><td>Cluster I</td></tr>
<tr><td>3.</td><td>Waterway stretch (from. To, total length)</td><td>Subarnrekha River (National Waterway No. 96)
(From Chandil Dam at Lat 22°58'29.39"N, Long 86° 1'14.03"E to confluence with Bay of Bengal at Lat 21°33'28.75"N, Long 87°22'58.60"E.);
Total Length as per TOR : 314 Km,
Surveyed Length : 314 Km
(0.0 Km Chainage starts from Bay of Bengal)</td></tr>
<tr><td>4.</td><td>Navigability status</td><td></td></tr>
<tr><td>a)</td><td>Tidal & non tidal portions (from ... to, length, average tidal variation)</td><td>Tidal portion: 0 - 40 Km
Non-tidal: 40 – 314.0 Km
Tidal variation: 1.7 m.</td></tr>
<tr><td>b)</td><td>LAD status
Survey period (.. to ..)
< 1.0 m (Km)
1.m to 1.5 m (Km)
1.5 m to 2.0 m (Km)
> 2.0 m (Km)</td><td>
<table>
<tr><th></th><th>0 - 50 Km</th><th>50 - 100 Km</th><th>100 – 150 Km</th><th>150 – 200 Km</th><th>200 – 250 Km</th><th>250 – 300 Km</th><th>300 – 314 Km</th><th>Total Km</th></tr>
<tr><td>Survey Period</td><td colspan="7">13rd Dec 2015 to 6th Jan 2016</td><td></td></tr>
<tr><td>< 1.0 m (Km)</td><td>10.31</td><td>3.65</td><td>0.00</td><td>18.24</td><td>8.73</td><td>4.07</td><td>5.42</td><td>50.42</td></tr>
<tr><td>1 to 1.5 m (Km)</td><td>4.66</td><td>10.42</td><td>4.50</td><td>5.85</td><td>9.68</td><td>4.61</td><td>2.40</td><td>42.12</td></tr>
<tr><td>1.5 to 2.0 m (Km)</td><td>2.56</td><td>6.78</td><td>15.24</td><td>4.37</td><td>7.16</td><td>11.26</td><td>1.90</td><td>49.27</td></tr>
<tr><td>> 2.0 m (Km)</td><td>32.47</td><td>29.15</td><td>30.27</td><td>21.55</td><td>24.43</td><td>30.06</td><td>4.27</td><td>172.19</td></tr>
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<table>
<tr><th>S. No.</th><th>Particulars</th><th>Details</th></tr>
<tr><td>c)</td><td>Cross structures
i) Dams, wires, barrages etc. (number, with navigation locks or not).
ii) Bridges, Power cables etc. [number, HC (... to ...). VC (.. to ..)]</td><td>i) Dams, Weirs, Barrages, Locks = 1 Barrage without Lock.
ii) Bridges = 21 numbers, HC (18 m to 5.0 m), VC (12 m to 7 m)
iii) Power Cable = 13 numbers (VC = 8.0 m to 5.0 m)
*Vertical clearance is above HFL on the basis of visual assessment.</td></tr>
<tr><td>d)</td><td>Avg. discharge and number of days in year</td><td>
<table>
<tr><th rowspan="2">Year</th><th colspan="2">Jamshedpur G&D Site (chainage 275 Km)</th><th colspan="2">Ghatsila G&D site (chainage 227 Km)</th></tr>
<tr><th>Average Q (m^3/sec)</th><th>No. of days in year</th><th>Average Q (m^3/sec)</th><th>No. of days in year</th></tr>
<tr><td>2004</td><td>144.92</td><td>80</td><td>155.29</td><td>82</td></tr>
<tr><td>2005</td><td>77.69</td><td>127</td><td>98.85</td><td>87</td></tr>
<tr><td>2006</td><td>263.73</td><td>84</td><td>330.32</td><td>87</td></tr>
<tr><td>2007</td><td>278.93</td><td>93</td><td>381.31</td><td>93</td></tr>
<tr><td>2008</td><td>290.68</td><td>112</td><td>317.33</td><td>111</td></tr>
<tr><td>2009</td><td>162.55</td><td>89</td><td>239.40</td><td>106</td></tr>
<tr><td>2010</td><td>31.72</td><td>97</td><td>58.19</td><td>93</td></tr>
<tr><td>2011</td><td>291.12</td><td>73</td><td>424.08</td><td>95</td></tr>
<tr><td>2012</td><td>145.54</td><td>93</td><td>227.52</td><td>98</td></tr>
<tr><td>2013</td><td>294.20</td><td>71</td><td>283.62</td><td>105</td></tr>
</table>
</td></tr>
<tr><td>e)</td><td>Slope (1 in ..)</td><td>
<table>
<tr><th>From G&D site</th><th>To G&D Site</th><th>River Slope (Average)</th></tr>
<tr><td>Jamshedpur</td><td>Ghatsila</td><td>1 in 1230</td></tr>
<tr><td>Ghatsila</td><td>Jamsholaghat</td><td>1 in 2000</td></tr>
<tr><td>Jamsholaghat</td><td>Rajghat</td><td>1 in 3200</td></tr>
</table>
</td></tr>
</table>

S. No.	Particulars	Details
f)	Consultants inference	➢ Considering the length of the river and availability of numerous minor and major industries 5km reach across the bank, the river has huge economic potential for Development of Waterway ➢ The capacity of the waterway can be enhanced by constructing check dams and lockgates, however the same shall be verified only on the basis of DPR stage studies, after the completion of detailed hydrographic and hydro-morphological survey of the complete stretch of waterway. ➢ The waterway will be an alternate mode of connectivity to the existing and proposed Ports coming up in the vicinity of Subarnrekha. ➢ Not only there is existing traffic but also the development of waterway will trigger new traffic.
5.	**Traffic potential**	
a)	Present IWT operations, ferry services, tourism, cargo, if any	Localised organised passenger ferry services are available in the initial tidal stretch of the waterway.
b)	Important industries within 50 km	The well-known Industries are Tata Iron and Steel Company (TISCO) and Hindustan Copper Limited (HCL). Some important small scale industries in the basin are tobacco products in Chakradharpur, cement, asbestos sheets, glass and ceramics at Chaibasa. Locomotives and coaches, automobiles, agricultural equipment, wires and cables, iron and steel machinery, metal tubes and conduits, copper and brass, chemicals (acids) and caustics, fertilizers and Soaps at Jamshedpur. The important minerals found in the basin are copper, uranium, chromium, gold, vanadium, limestone, dolomite, asbestos, china clay, talc and building stones besides iron and aluminium. Apart from these there are several Brick kiln present along the Subarnrekha River
6.	Consultant's recommendation for going ahead with Stage-II (DPR preparation)	Subarnrekha waterway is recommended for Stage – II DPR preparation in view of the following potential advantages: a) Connectivity of major industrial towns with Subarnrekha waterway gives it an additional economic advantage. b) Connectivity with a major port proposed at confluence of river with Bay of Bengal. c) Increasing cargo potential. d) Reduction in existing traffic load on rail and road infrastructure.

1.0 CONTEXT

IWAI, Ministry of Shipping, Government of India is exploring the potential of additional waterways across the country for year round commercial navigation, for this it is planned to conduct a Feasibility Study and recommending thereafter the possibility of Composite and Integrated development of National waterways to achieve navigation and to develop water transport facilities across India. Upon completion of feasibility study, IWAI will select the stretches having potential for navigation to undertake a Detailed Project Report. The DPR stage would include detailed hydro-graphic surveys and investigation, traffic survey, proposed location for terminals and cost assessment etc.

There are 106 new waterways has been identified and declared as national waterways as per "The National Waterway Act, 2016", No. 17 of 2016, published in the Gazette of India, Part – II- Section 1 no. 18, New Delhi, Saturday, March 26/2016/Chaitra 6, 1938 (Saka), by Ministry of Law and Justice (Legislative Department).

Out of these 106 waterways, IWAI had invited international online bids for preparation of 2 stage Detailed Project Report (DPR) for National waterways, in a set of 8 Clusters from Cluster I to VIII through Tender No. IWAI/PR/40NW/2015. Egis Consulting Engineers was awarded the work for Cluster I and Cluster III respectively.

This feasibility report provides the technical viability of throughout the year inland navigation in the waterways, by taking into constraints and other functions of the rivers/canals such as water conveyance, tidal effects, floods, draughts, existing structures etc.

As stated above, 7 rivers out of 106 national waterways are clubbed in Cluster – I of two stages DPR studies for National waterways project. The detail descriptions of these 7 waterways are presented in **Table 1**. The total length of stretches of 7 rivers under Cluster – I is 820 km. Among these 7 waterways, 5 are connected to the National Waterway 1 between Farakka to Haldia.

Table 1: National Waterways of Cluster – 1

S. No	River	National Waterway No.	Length (km)	Description
1.	Ajoy River	National Waterway 7	96	From Bridge on Morgram-Panagarh State Highway No 14 at Illambazar Lat 23°36'56.10"N, Long 87°31'58.07"E to confluence of river Ajay with river Bhagirathi at Katwa Lat 23°39'23.33"N, Long 88° 7'56.72"E
2.	Damodar River	National Waterway 29	130	From Krishak Setu, Bardhman on State Highway No 8 at Lat 23°12'39.83"N, Long 87°50'53.85"E to confluence with Hooghly river near Purbba Basudebpur at Lat 22°21'0.58"N, Long 88° 5'19.31"E
3.	Dwarekeswar River	National Waterway 35	113	From Bridge near Abantika Lat 23° 6'54.76"N, Long 87°18'46.99"E to confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E.
4.	Ichamati River	National Waterway 44	64	From Bridge on Border Main Road at Gobra near Bangladesh Border at Lat 22°53'49.64"N, Long 88°53'48.87"E to near Bangladesh Border at Bansjhari Mallikpur Lat 22°39'6.71"N, Long 88°55'35.35"E.
5.	Rupnarayan River	National Waterway 86	72	From confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E to confluence with Hooghly river at Geonkhali Lat 22°12'41.58"N, Long 88° 3'13.99"E
6.	Silabati River	National Waterway 92	26	From Barrage near Shimulia village at Lat 22°34'53.20"N, Long 87°38'30.54"E to confluence of Dwarakeswar and Silai rivers at Pratappur Lat 22°40'16.94"N, Long 87°46'42.57"E.
7.	Subarnrekha River	National Waterway 96	314	From Chandil Dam at Lat 22°58'29.39"N, Long 86° 1'14.03"E to confluence with Bay of Bengal at Lat 21°33'28.75"N, Long 87°22'58.60"E.

The detailed layout plan of the above waterways is shown in Drawing No. PT/EIPTIWB003/2016/FR/0001 and provided in **Figure 1**.

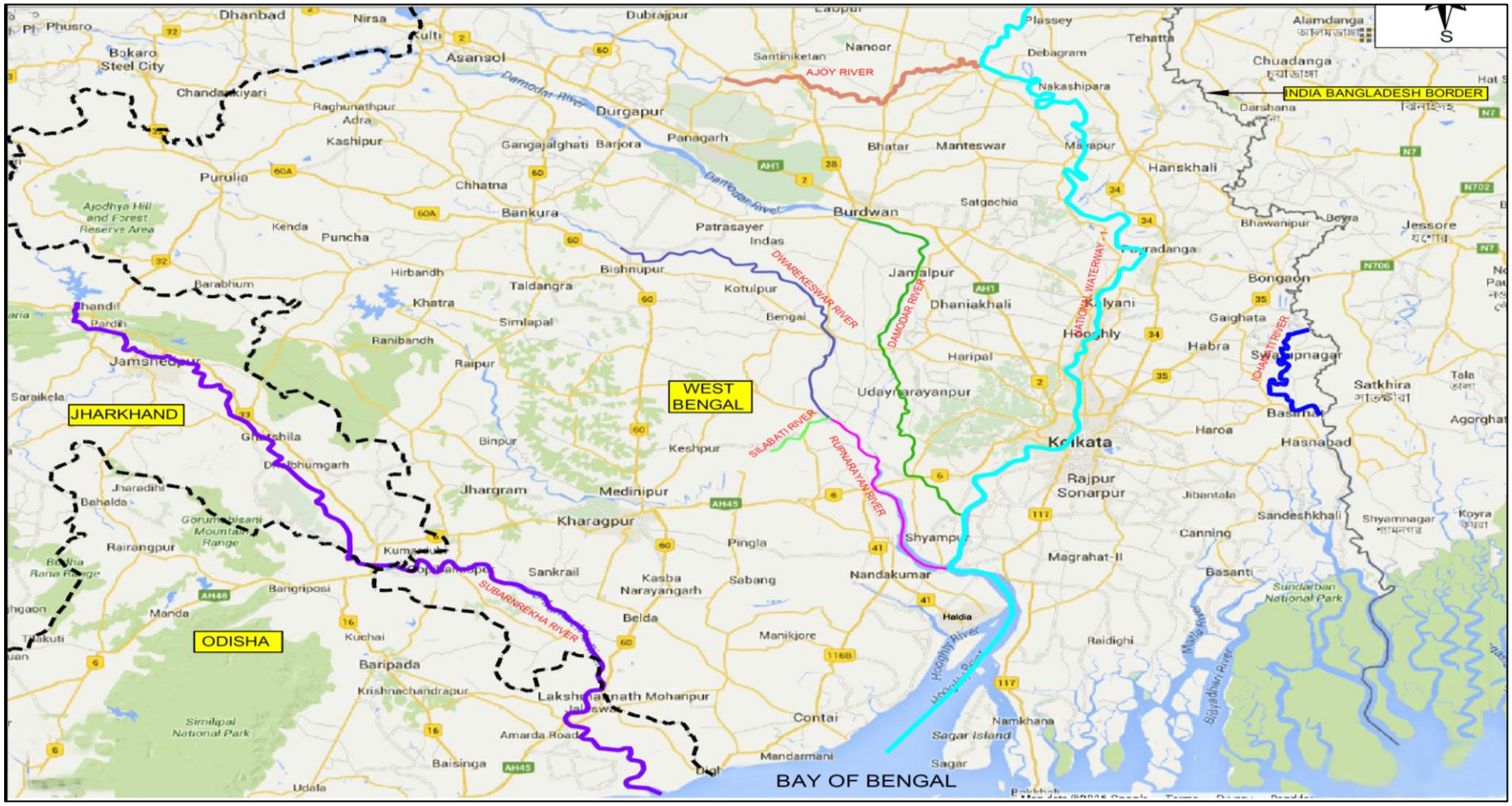


Figure 1: Layout Map of Cluster 1 National Waterways

2.0 OBJECTIVE

Government of India intends to explore the potential of additional waterways across the country for year round commercial navigation, for this it is planned to conduct a Feasibility Study and recommending thereafter the possibility of Composite and Integrated development of National waterways to achieve navigation and to develop water transport facilities across India. The whole of study comprises of two stages, feasibility and DPR as Stage-I and Stage-II as presented below.

Stage-1

1A. Reconnaissance Survey

1B. Collection and review of available data

1C. Feasibility Report

Stage-2

2A. Hydrographic Survey & hydro-morphological survey

2B. Traffic Survey & Techno economic feasibility

2C. Preparation of Detailed Project Report

The current scope for stage-I is executed as per following framework as per **Figure 2** .

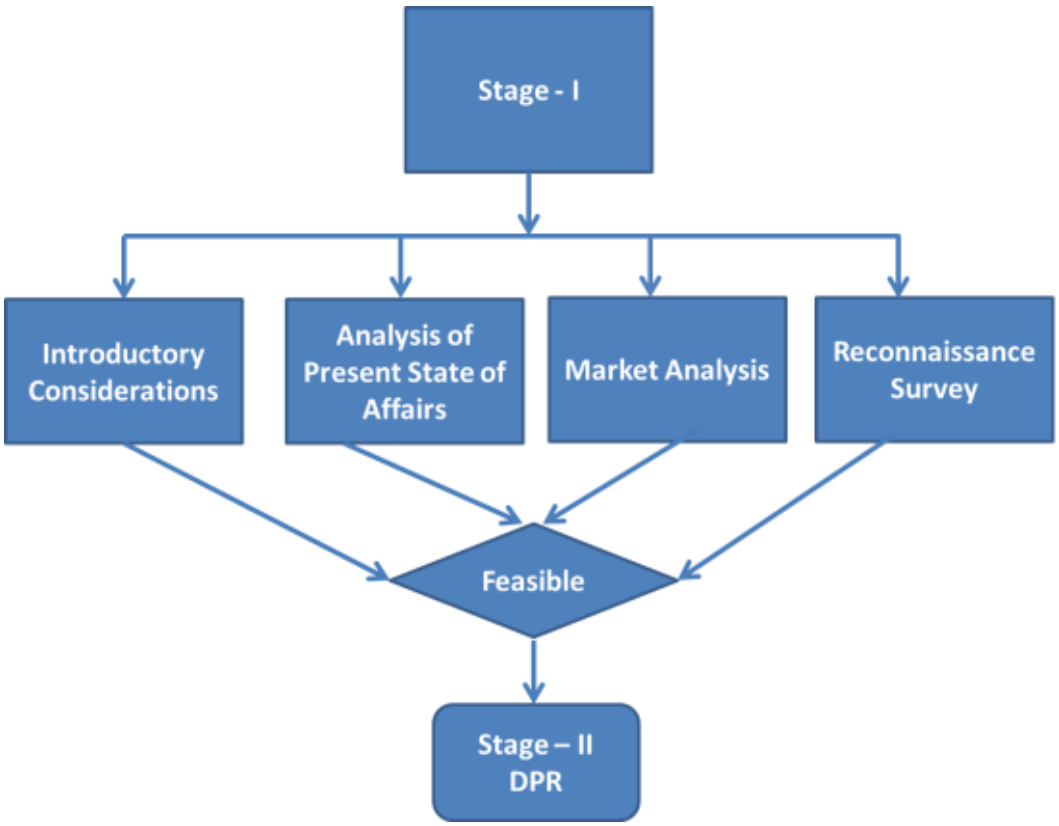


Figure 2: Framework of Studies

3.0 REPORT STRUCTURE

This report comprises of Feasibility Study for Subarnrekha River (Length- 314 Km). The report is arranged in following main chapters,

I. **Introductory Consideration**: This section comprises of,

1) Name of the river/canal;
2) Length of the river/canal;
3) State/ District through which river passes;
4) Map;
5) Characteristics of River;
   a. River Course: Background/Historical information, Origin, End
   b. Tributaries/ Network of Rivers/ Basin
6) Methodology Adopted to undertake the Study;
   a. Primary Data
   b. Secondary Data

II. **Analysis of Present State of Affairs**: This section comprises of,

1) Existing Dams, Barrages and Locks;
2) Existing Bridges and Crossings over River;
3) Other Cross structures, High Tension Lines, pipe-lines, cables;
4) Hindrances/ Encroachment to the Waterway;
5) Details of Protected Area- Wildlife, Defence;
6) NH/SH/MDR along and/or in vicinity;
7) Railway Line and Stations in the vicinity.

III. **Reconnaissance Survey**: This section provides the,

1) Methodology adopted including resources and equipment;
2) Description of Bench marks, reference levels, chart and sounding datum;
3) Details of collected water levels, discharge data, HFL and FSL;
4) Details and description of bathymetric and topographic survey including observations;
5) Detail about Soil, Water and Bank characteristics.

IV. **Market Analysis**: This section comprises of,

1) Land use pattern along Waterway;
2) Crop/Agriculture in the region;

3) Availability of Bulk/Construction Material;
4) Existing industries along waterway;
5) Details of existing Jetties and Terminals;
6) Preliminary traffic identified;
7) Existing cargo movement;
8) Prominent City/ Town/ Places of worship/ Historical places for tourism;
9) Availability of passenger ferry services;
10) Available and probable water sport/recreational facilities.

V. **Observation and Inferences**: This section comprises of,
1) Observation on Waterway, Length, LAD, Cross-Structures;
2) Water availability for different periods and depths;
3) Cargo/Passenger/Tourism/RO-RO facility;
4) Suitability of waterway for navigation;
5) Proposed alternative methods for making waterway feasible;
6) SWOT analysis;
7) Way forward for Stage – 2 DPR studies.

In addition to the above, following digital data and charts shall also be submitted along with this report:

I. **Bathymetric Survey**: Hypack software output files with RAW, EDIT, SORT, TIDE extensions;
II. **Topographic Survey**: csv and xyz extension files;
III. **Survey Charts**: Geo-coded dxf and dwg files in scale as per width in AutoCAD formats;

4.0 INTRODUCTORY CONSIDERATIONS

The Consultant discussed here, the introductory considerations for feasibility and the scope of the assignment in subsequent phase of DPR for feasible stretches.

The present feasibility report provides the technical feasibility of Subarnrekha River, declared as National Waterway 96, clubbed under Cluster – I, as stated in earlier sections. The detail description of the waterway analysed in this feasibility report are described in subsequent paragraphs.

4.1 DETAILS OF NATIONAL WATERWAY 96 (SUBARNREKHA RIVER)

Details of the waterways are as follows:

Table 2: Description of River

Name of the River	Local Name	Length of waterway (km)	State/District through which river passes
Subarnrekha River	• Subarnrekha • Swarnarekha	314.0 Km (Surveyed Length)	**State: Jharkhand** *Ranchi District* *Seraikela Kharsawan District* *East Singhbhum District* **State: West Bengal** *Paschim Medinipur District* **State: Odisha** *Balasore District*

4.2 Characteristics of Subarnrekha River

Characteristics of Subarnrekha River considered for waterway is described in subsequent paragraph.

River Course: Subarnrekha River flows through the Indian states of Jharkhand, West Bengal and Odisha. After originating near Piska/ Nagri, near Ranchi, the capital of Jharkhand, the Subarnrekha traverses a long distance through Ranchi, Seraikela Kharsawan and East Singhbhum districts in the state. Thereafter, it flows for shorter distances through Paschim Medinipur district in West Bengal for 83 kilometres and Balasore district of Odisha. There, it flows for 79 kilometres and joins the Bay of

Bengal near Talsari. The total length of the river is 395 kilometres. The basin of the Subarnrekha is smaller than most multi-state river basins in India. The rain-fed river covers a drainage area of 18,951 square kilometres.

Catchment Area: The River Subarnrekha (also called Swarnarekha) though it has small catchment as compared to other multistate rivers, has got separate entity as it directly falls into the Bay of Bengal. Originating in the Chhotonagpur Range at an elevation of 609 m, it traverses through three states – Jharkhand, West Bengal and Orissa. It drains a total area of 19,671 sq.km.

Tributaries: The important tributaries on the right bank of this river are Kanchi and Kharkai which meet Subarnrekha above Chandil dam and another right bank main tributary named as Kharkai meets this river near Jamshedpur upstream of Galudi barrage. Dulung is the main tributary which joins Subarnrekha from its left in the Paschim Medinipur district of West Bengal.

The total length of this river is 395 km out of which 83 km lies in West Bengal and 79 km in Odisha.

Table 3: Catchment Area and Tributaries of Subarnrekha River

River Basin	Catchment Area in Sq. Km			Total sq. Km.	Tributaries
	Jharkhand	West Bengal	Odisha		
Subarnrekha Basin	13014.0	3581.0	3076.0	19671.0	Kharkai, rarhu, Kanchi, Damru, Karru, Chinguru, Karakari, Gurma, Garra, singaduba, Kedia, Shankh, Dulung, Khaijori

The section of the Subarnrekha River under feasibility study for inland waterway is presented in Drawing No. PT/EIPTIWB003/2016/FR/0008A and is also presented as **Figure 3**. The detail layout maps of the waterway are shown in Drawing No. PT/EIPTIWB003/2016/FR/0008.

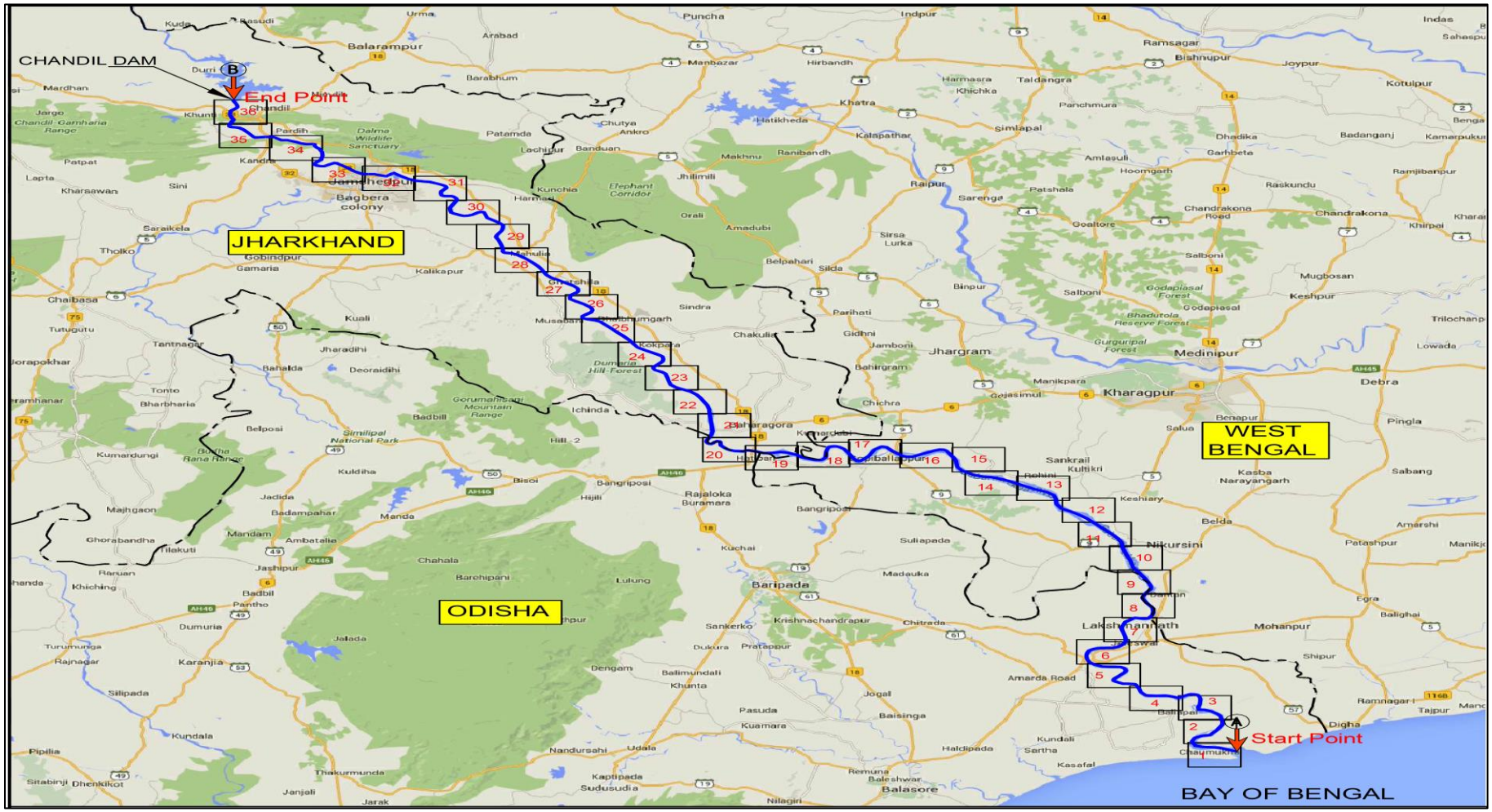


Figure 3: Layout Map of Subarnrekha River Waterway

4.3 Methodology Adopted to Undertake Study

A detail description on Feasibility & DPR methodology and the expected outcome in fulfilling the assignment is presented.

The feasibility study shall be carried out in accordance with TOR in the following steps:

1. Conducting Reconnaissance survey as detailed in Chapter 5.
2. Collection and review of available primary and secondary data as detailed in Chapter 6 and 7.

On the basis of detailed analysis of collected primary and secondary data, throughout the year navigability potential of the waterway is assessed and submitted in the feasibility report.

4.3.1 Classification of Waterways[1]

The classification of waterways by Inland Waterway Authority of India is discussed below and shall be adopted in the study.

1. The waterways shall be classified in the following categories for safe plying of self-propelled vessels up to 2000 tonne Dead Weight Tonnage (DWT) and tug-barge formation in push-tow units of carrying capacity up to 8000 tonne, namely:

   a. **Class I** - Waterways with the following configuration of navigable channel:-
   - i. Rivers: Minimum of 1.2 meter depth, 30 meter bottom width, 300 meter bend radius, 4 meter vertical clearance and 30 meter horizontal clearance between piers, and
   - ii. Canals: Minimum of 1.5 meter depth, 20 meter bottom width, 300 meter bends radius, 4 meter vertical clearance and 20 meter horizontal clearance between piers.

   b. **Class II -** Waterways with the following configuration of navigable channel:-
   - i. Rivers: Minimum of 1.4 meter depth, 40 meter bottom width, 500 meter bend radius, 5 meter vertical clearance and 40 meter horizontal clearance between piers, and

[1] A Compilation of The Inland Waterways Authority of India Act, 1985 and Regulations on i) Presentation of Collision; ii) Safety of Navigation; iii) Classification of Waterways in India.

ii. Canals: Minimum of 1.8 meter depth, 30 meter bottom width, 500 meter bend radius, 5 meter vertical clearance and 30 meter horizontal clearance between piers.

c. Class III - Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 1.7 meter depth, 50 meter bottom width, 700 meter bend radius, 7 meter vertical clearance and 50 meter horizontal clearance between piers, and

ii. Canals: Minimum of 2.2 meter depth, 40 meter bottom width, 700 meter bend radius, 7 meter vertical clearance and 40 meter horizontal clearance between piers.

d. Class IV - Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.0 meter depth, 50 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 50 meter horizontal clearance between piers, and

ii. Canals: Minimum of 2.5 meter depth, 50 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 50 meter horizontal clearance between piers.

e. Class V - Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.0 meter depth, 80 meter bottom width, 800 meter bend radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers.

f. Class VI - Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.75 meter depth, 80 meter bottom width, 900 meter bend radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers, and

ii. Canals: Minimum of 3.5 meter depth, 60 meter bottom width, 900 meter bend radius, 10 meter vertical clearance and 60 meter horizontal clearance between piers.

g. Class VII -Waterways with the following configuration of navigable channel:-

i. Rivers: Minimum of 2.75 meter and above depth, 100 meter and above bottom width, 900 meter bends radius, 10 meter vertical clearance and 80 meter horizontal clearance between piers.

2. Vertical clearance for power cables or telephone lines or cables for any transmission purpose for all the classes of waterways mentioned above shall be as follows:

a. Low voltage transmission lines including telephone lines - 16.5 meters

b. High voltage transmission lines, not exceeding 110 kilo volt - 19.0 meters

c. High voltage transmission line, exceeding 110 kilo volt - 19.0 meters

+1 cm extra for each additional kilovolt

3. In case of underwater pipelines, power cables and other cables, norms to be followed shall be decided as per the site conditions and navigational requirement.

Provided that this classification shall be effective for:

a. Minimum depth of channel should normally be available for about 330 days of the year.
b. Vertical clearance at cross structure over the waterway should be available at least in central 75% portion of each of the spans in entire width of the waterway.

Reference level for vertical clearance in different types of channel shall be:

a. For rivers, over Navigational High Flood Level (NHFL), this is the highest flood level at a frequency of 5% in any year over a period of last twenty years.
b. For tidal canals, over the highest high water level.
c. For other canals, over designed full supply level.

4.3.2 Measures to Improve the Depth

The basic parameters considered for the fairway design are:

- Depth
- Width
- Side slopes
- Bends

As explained above, as the classification of waterways in India is based on the experience gained in various waterways, the characteristic features of the design waterways based on studies carried out by IWAI are furnished below and the same shall be followed.

Fairway Design

The fairway depth should be good enough to ensure steerability of the vessel and to prevent bottom feel. To meet this requirement, the minimum depth that is needed in a channel would commonly be the sum of the draught (draft) of the vessel and other tolerance factors. The tolerance factors to be considered are listed as:

- Factor of keel clearance to avoid touching of the vessel to the ground and minimum free water below the keel for maintaining control on manoeuvring,
- Wave tolerance for the heaving and pitching of the vessel due to wave motion,
- Squat, increase of draft due to ship motion,
- Tolerance for siltation and dredging,
- Increase of draught due to trim and heaving due to unequal loading and steering manoeuvre respectively, and
- Tolerance for the change of draught during the transition from salt water to fresh water.

The keel clearance factor is the prime concern of the all tolerance factors considered. As per the standards laid down by German Code of practice (EAU 80), a 0.3 m layer of water column below the keel of the loaded ship is sufficient for free manoeuvrability of the vessel.

IWAI's experience in inland waterways in India and sub-continent (Bangladesh and Myanmar) shows that the under keel clearance for free manoeuvrability of the vessel varies between 0.2 and 0.5 m depending upon the soil characteristics of the channel bed and other parameters.

Width of a Channel

The total width of a navigation waterway (W) in general is expressed in terms of a beam of a vessel (B). The design width for the proposed two-way navigation can be obtained as:

$$W = BM + BM1 + C + 2C1$$

Where: W = Navigation channel width for two-way navigation.

BM = Maneuvering zone for the design vessel which takes into account the directional stability of vessel.

BM1 = Maneuvering zone for the upcoming vessel which takes into account the directional stability of vessel.

C = Width of separating zone.

C1 = Width of the security area, between the maneuvering zone and the channel side which is accounted for environmental and human factors including bank suction.

Values recommended by various authorities for the above equation vary within wide limits. Some of the recommended values are presented here:

BM = 1.3 B to 3.0 B

BM = BM1

C = 0.5 B to 1.0 B

C1 = 0.3 B to 1.5 B

Where, B = Beam of a design vessel.

Based on the experience and recommendations of experts on Inland Waterways, the factors considered for the present design are:

BM = 1.8 B

BM = BM1

C = 0.5 B

C1 = 0.5 B

The designed channel width = 1.8B+1.8B+0.5B+2x0.5B for two way navigation at draft level = 5.1B. The bottom width of the channel for two-way navigation for the design vessel can generally be considered as 5 x B.

Slopes

The selection of slope is in accordance with the soil characteristics of the bed and banks, width of the waterway etc. The adopted channel slope shall be 1:5

Width Allowance at Bends

In bends, the width of the fairway should be more than the width of the canal that is designed for a straight reach to allow for a drift of the vessel in a curved portion of the waterway. It means that the vessel occupies a greater width in bends than in a straight stretch of the waterway. The drift of the vessel depends on the radius of the bend, the speed of the vessel, wind forces, the flow pattern and the loading of the vessel. The drift angle is larger for vessels traveling in the downstream than the upstream direction. The drift angle is inversely proportional to the bend radius 'R', that is, the larger the radius the smaller the value of drift angle. Unloaded ships normally subjected to more drift and consequently take up a greater width in bends than loaded ships and therefore the proposed allowance at the keel level of the unloaded ships is larger than the loaded ships.

Dredging of Navigational Channel

The dredging quantities for the above design channel shall be worked out based on the bathymetric surveys carried out. The system and different type of navigation marks shall be proposed in the DPR are given as follows:

- Lateral marks, to mark the left and right sides of the navigation route to be followed by navigator;
- Bifurcation marks, to mark the middle ground between the navigation channel, bifurcated channel and isolated dangers in the middle of the navigational channel;
- Shore marks;
- Bank wise marks, to indicate the channel at point where it approaches a bank;
- Crossing marks, to indicated crossing and alignment of the channel from one bank to another;
- Marks of prohibited areas, to indicate no permission of entry;
- Sound signal marks, to indicate use of horning or other sound signals;
- Marks for traffic control, to control up bound or down bound vessel in one way or sequence passage or to prohibit navigation;
- Marks on bridges, to indicate the passage through bridges;
- Depth indicator marks, to indicate shallow areas ahead in the navigation channel;
- Width indicator marks, to indicate the narrow stretches ahead in the navigational channel;
- River training marks, to indicate the ongoing river training works in the river to the navigators.

4.3.3 IWT Terminal Planning

The terminal planning and design includes selection of suitable sites in the vicinity of cargo potential considering all the relevant technical variables such as choosing the type of berthing facility and providing of covered/open storage facility, cargo handling systems and other ancillary facilities required for efficient terminal operation. Based on the projected traffic, the selection of various facilities shall be planned. The cost estimate including capital and operating costs shall be estimated for each of the proposed system considering the design. These above aspects are briefly explained in the following subsequent sections.

Planning Considerations

The terminal facilities proposed for this project shall include the following:

i) Berthing Facilities for vessels;
ii) Cargo Storage Facilities;
iii) Cargo Handling Facilities;
iv) Other ancillary Facilities.

Terminal Facilities

The type of cargo handling system required at the terminal is generally dependent on the type of cargo, the annual volume required to be handled and the size of the vessels. The various type of cargo foreseen to be handled at the proposed IWT Terminals are primarily grouped into:

i) Incoming Cargo, and
ii) Outgoing Cargo.

These above two groups are further subdivided into bulk, bagged and other miscellaneous general cargo for the purpose of planning the cargo handling equipment. The quantum and other cargo compositions shall be based on the traffic study. The same may be classified as below:

- Bulk Cargo - Construction materials such as Sand, stone, bricks, Marble, Iron steel, Machinery – Light, Heavy and ODC, Mineral Ore such as coal, lime stone, iron, fly ash, copper ore etc., bamboo, etc.
- Bagged Cargo - Cement, Fertilizer, wine and beverages, acids, cereals, cash crops, wheat, rice, Bajra, gram, pulses, cotton, etc.
- Misc. General Cargo – Consumer goods, animals, oil cake, edible oil, refined oil, paper products, jute products, etc
- Ferry – Passenger vessels for Tourists

4.3.4 Identification of IWT Terminals

Site selection is the most important as it decides the investment for establishing the terminal facilities. Hence, proper consideration has to be given to select the most optimum location which will minimise the capital investment and other recurring cost during operation. The selection of suitable site shall be carried out with the view of following considerations:

- Water availability near the terminal land throughout the year especially during lean season;
- Stable river channel with sufficient depth;
- Favourable hydraulic conditions for berthing and cargo handling;
- Availability of terminal land for infrastructure, cargo storage and handling;
- Traffic potential and cargo characteristics; and
- Navigational safety.

The proposed IWT Terminals shall be planned with the following infrastructure facilities for operation:

i) Steel Gangway resting on a floating pontoon. The detailed engineering & design of gangway arrangement shall be carried out during the construction stage. The preliminary layout drawing shall be proposed in the DPR;
ii) Administration Building and Bank protection arrangement;
iii) Covered Storage Shed/Transit Shed;
iv) Open storage area;
v) Security Shed;
vi) Forklift Trucks, Pay loaders & Dumper tracks; and
vii) Weigh Bridge, Watch and ward, Compound wall, Firefighting arrangement, Electrical & PH Facilities including DG.

The terminal shall be proposed with suitable mooring facilities, firefighting water line, water supply pipeline, power line for shore connection to barges, fenders etc. Preliminary planning and master plan shall be prepared in the DPR stage as per the relevant IS codes. It is envisaged and proposed that to the extent possible, all shore/river bank based buildings / godown are prefabricated, pre-engineered type conforming to the best standards in vogue in logistic / supply chain industry.

Other Alternatives to Improve for Navigation

Based on our earlier study for Ganga River between the reach from Allahabad to Ghazipur, there are many methods available to improve river navigation. Bandalling work – it has to follow closely falling stage of river, closing minor channels and diverting river flow in single channel to increase depth in the navigable channel in mainly due done by bandalling. In some reaches this method becomes successful but some river stretches remain shallow and need other training measures including dredging. Channelization of river and Construction of barrages at suitable locations, creating ponding conditions with required depth and navigational locks for ships and vessel movement shall be studied. The examination of various options/measures to improve the water depth shall be studied. The most suitable method for development shall be identified with consideration on the likely morphological, sediment transport, and dredging aspects of different options. This task is expected to be fed back into from the financial and economic analysis providing refinement to the proposed development until a recommended solution is reached. The most appropriate type of river development including drudging option along the river shall be identified and likely impacts of these developments on river flow depths as well as sedimentation and morphology shall be investigated. This analysis will constitute an iterative process in which problems relating to LAD will be addressed to find more successful solutions where necessary. This will however, not be an open-ended process as the

assessment of techno-economic feasibility updation only requires an indication of the likely costs of building and maintaining the structures which are shown to support achievement of LAD as intended.

4.3.5 Rapid EIA

Suitable Rapid Environmental Impact Assessment shall be performed and report shall be included in final DPR. The Rapid EIA Studies can be broadly divided in to three phases.

- The first phase involves identification of significant environmental components in the area where the project is located and assessing their baseline (pre-project or existing) status within the study zone. In case of existing projects, environmental performance of existing manufacturing / pollution control plants is also required to be covered.
- The second phase involves prediction of impacts on various identified significant environmental parameters due to project.
- The third phase includes the evaluation of final impacts and delineation of an Environmental Management Plan to mitigate adverse impacts on the quality of surrounding environment.

4.3.6 Concept Design and Cost Estimates

Preliminary Design shall be performed for all the structures /developmental works proposed as per the above analysis and mathematical model studies carried out conforming to relevant IS Codes. Design drawings shall be prepared and submitted based on the preliminary design. Bill of quantities and cost estimates shall be prepared for all the proposed structures / developmental works. Based on the cargo potential and other considerations necessary for locating an IWT terminal, extent of land required for setting up of IWT terminals and other suitable locations shall be identified. Preliminary topographic survey shall be carried out and layout plan for all suggested locations shall be prepared clearly indicating all facilities e.g jetty, approach to jetty, bank protection, covered and open storage, roads, office, sentry hut, boundary wall, bank protection, bunkering facility, water facility, turning circle for IWT vessels location of depth contours of 2m and 2.5m in the river near the terminal sites. Preliminary engineering design and drawings for setting up of terminals with related facilities including mechanical loading/ unloading at the proposed sites shall be prepared. Also inter modal cargo transfer facilities required at these terminals shall be indicated.

4.3.7 Financial and Economic Analysis

Financial and economic analysis through FIRR and EIRR of the project including SWOT analysis shall be carried out for the project. For the Financial Internal Rate of Return shall be computed as follows:

- Costs shall be calculated as total capital investment for the Project components, net rate of interest charges during construction and operations & maintenance costs for the Project;
- Income flows shall be calculated based on gross revenues of projected goods to be transported through private operators with permissible assumptions such as project life etc.;
- Economic Internal Rate of Return shall be computed taking into account the following factors;
- The assumed life of the project as per norms;
- Costs shall be calculated as Government contribution and other sources. A standard conversion factor shall be used to reduce financial costs to economic costs;
- Benefits shall be estimated as Government revenues, calculated as net profit share, royalties and tax;
- Social Benefits like fuel saving, reduction in environment pollution and carbon emission, accident reduction, decongestion of rail and roads, etc.

The financial viability and sustainability of this project depend upon the adaptation to the prevailing context in which they operate. In working out the Financial Viability and sustainability, the following factors shall be considered.

- budgeting and cost accounting systems,
- resource mobilization for capital investments,
- cost recovery and operational financing,
- cost reduction and control.

The Profitability projections and financial analysis for each of the project components shall be worked out in detail and presented in the report. The financial statements shall be prepared on the basis of the suitable assumptions. The cost benefit analysis for the project shall be calculated. The Net Present Value (NPV) with interest and depreciation, IRR and preliminary expenses shall be suitably considered and estimated. Break-even analysis shall be performed and presented in the report.

4.3.8 Implementation & Monitoring Mechanism

Project financial structuring shall be worked out in detail which will examine the sources and composition of funding for the project. The Project financial structuring can involve a combination of equity, grant, debt and finance from private participation (and in some cases, contribution from user communities). The scope and options for possible debt and private sector financing shall be reviewed elaborately and presented in the report. The suitable monitoring mechanism shall be evolved.

5.0 COLLECTION AND REVIEW OF DATA

5.1 Primary Data

In order to collect primary data and to access the latest hydro-morphological condition of the national waterways, reconnaissance survey was done. Following aspects had been covered in the reconnaissance survey as per TOR:

a) Single line longitudinal survey (Bathymetric survey or Topographic survey) in the deepest depths or lowest height lands, with the help of DGPS using Automatic Hydrographic Survey System. Bathymetric surveys in the waterways are to be carried out in the deepest route. Deepest route can be accessed by taking two or three longitudinal line soundings at equal interval. Topographic survey, if required, is to be taken up at lowest ground levels, which can be decided on visual assessment.

b) Details (horizontal and vertical clearances above High Flood Level of bridges, aqueducts, electric lines, telephone lines, pipe lines, cables en-route are to be collected and indicated on the chart and also included in the report along with their co-ordinates and location. Details about Barrages, Dams, Locks en-route are also to be collected horizontal and vertical clearance is to be given as approximate on visual assessment.

c) Photographs are required to be submitted in the report.

d) Topographical features of the Inland Waterways.

e) Typical physical features along the alignment i.e. land use pattern:

f) Preliminary identification of stretches having year round flow and critical depth for navigational purpose.

g) Inventory of major aspects including Inland Waterway width, Terrain, Bridges and structures across the Inland Waterways (Type, size and location), urban areas (location extent). Geologically sensitive areas environmental features. Hydrological features

h) Critical areas requiring detailed investigations and

i) Requirements for carrying out supplementary investigations

j) Soil (textural classifications) (only visual inspection at every 10km) and drainage conditions.

k) Type and extent of existing utility services along the alignment.

All the above details are collected during field survey as well as by interaction with the concerned authorities from 13th December 2015 to 6th January 2016 by the consultant.

5.2 Review of Secondary data

Location: The Subarnrekha is one of the longest east flowing inter-state rivers. It covers large areas of Jharkhand and some parts of Orissa and West Bengal. The basin lies between north latitudes of $21^0$33' to $23^0$32' and east longitudes of $85^0$09' to $87^0$27' situated in the northeast corner of the peninsular India. It is bounded on the northwest by the Chhotanagpur Plateau, in the south west by Brahmani Basin, in the south by Burhabalang basin and in the south-east by the Bay of Bengal. This river originates near Nagri village in Ranchi district of Jharkhand at an elevation of 600 m. The total length of the river is about 395 km. Its principal tributaries are Kanchi, Kharkai, Karkari and Dulang. The basin is generally influenced by South-West monsoon, which breaks in the month of June and extended upto October.

Irrigation Projects: The Kanchi Irrigation Schemes is the only Major Project. Besides, there are ten Medium Irrigation Projects in the catchment areas of the river basin in Jharkhand.

Urban Centres: The important cities/ towns in the basin are Jamshedpur, Ranchi and Muri.

Industries: Important industries in the basin are tobacco products in Chakradharpur, cement, asbestos sheets, glass and ceramics at Chaibasa. Locomotives and coaches, automobiles, agricultural equipment, wires and cables, iron and steel machinery, metal tubes and conduits, copper and brass, chemicals (acids) and caustics, fertilizers and Soaps at Jamshedpur.

Minerals: The important minerals found in the basin are Coal, Iron ore, Bauxite, Copper, uranium, chromium, gold, vanadium, limestone, dolomite, asbestos, china clay, talc and building stones besides iron and aluminum.

Hydrological Sites: There are 6 sites. All 4 types of data – gauge, discharge, sedimentation and water quality - are collected from 3 of these sites: Ghatsila, Jamshedpur and Adityapur. In one site at Muri data are collected for gauge, discharge and water quality. At site Fekoghat, data are collected for gauge, discharge and flood forecasting. And in site Jamsholaghat, gauge & discharge data are collected. Besides these 6 sites there are 3 water quality sample collection points (without any regular CWC set-up).

In addition to above, a gauge site is also located at Rajghat established by Odisha Water Resources Department.

Table 4 provides the details of gauge sites located along the waterway and the historic levels as per the "Integrated Hydrological Data Book" published by CWC dated 2012 and gauge data provided by IWAI from the year 1972 to 2014. Ten years observed water levels (2003 to 2014) at the four G&D sites located along Subarnrekha are plotted and provided from **Figure 4** to **Figure 7**.

Table 4: Details of Gauge Site and Historic Water Levels along Subarnrekha Waterway

S. NO	Site Name	Period of Record	Warning Level (m)	Danger Level (m)	HFL (m)	Date	Maximum Water Level			Minimum Water Level		
							Water Level (m)	Date	Discharge (cumecs)	Water Level (m)	Date	Discharge (cumecs)
1	Jamshedpur (Chainage = 275 km)	01/02/72 - 31/05/14	Not Available	Not Available	129.820	12/10/73	126.26	03/09/73	7673.89	113.72	06/04/76	1.3
2	Ghatsila (Chainage = 227 km)	01/04/72 - 31/05/14	Not Available	Not Available	86.835	13/10/73	85.05	17/08/74	9579.59	73.02	20/04/72	2.8
3	Jamsholaghat (Chainage = 167 km)	01/02/76 - 31/05/14	48.320	49.160	56.755	Not Available	56.91	09/09/78	Not Available	42.395	29/02/80	Not Available
4	Rajghat (Chainage = 51.4 km)	01/06/72 - 31/05/14	9.450	10.360	12.690	19/06/08	12.69	19/06/08	(Gauge Station only)	4.36	07/06/79	(Gauge Station only)

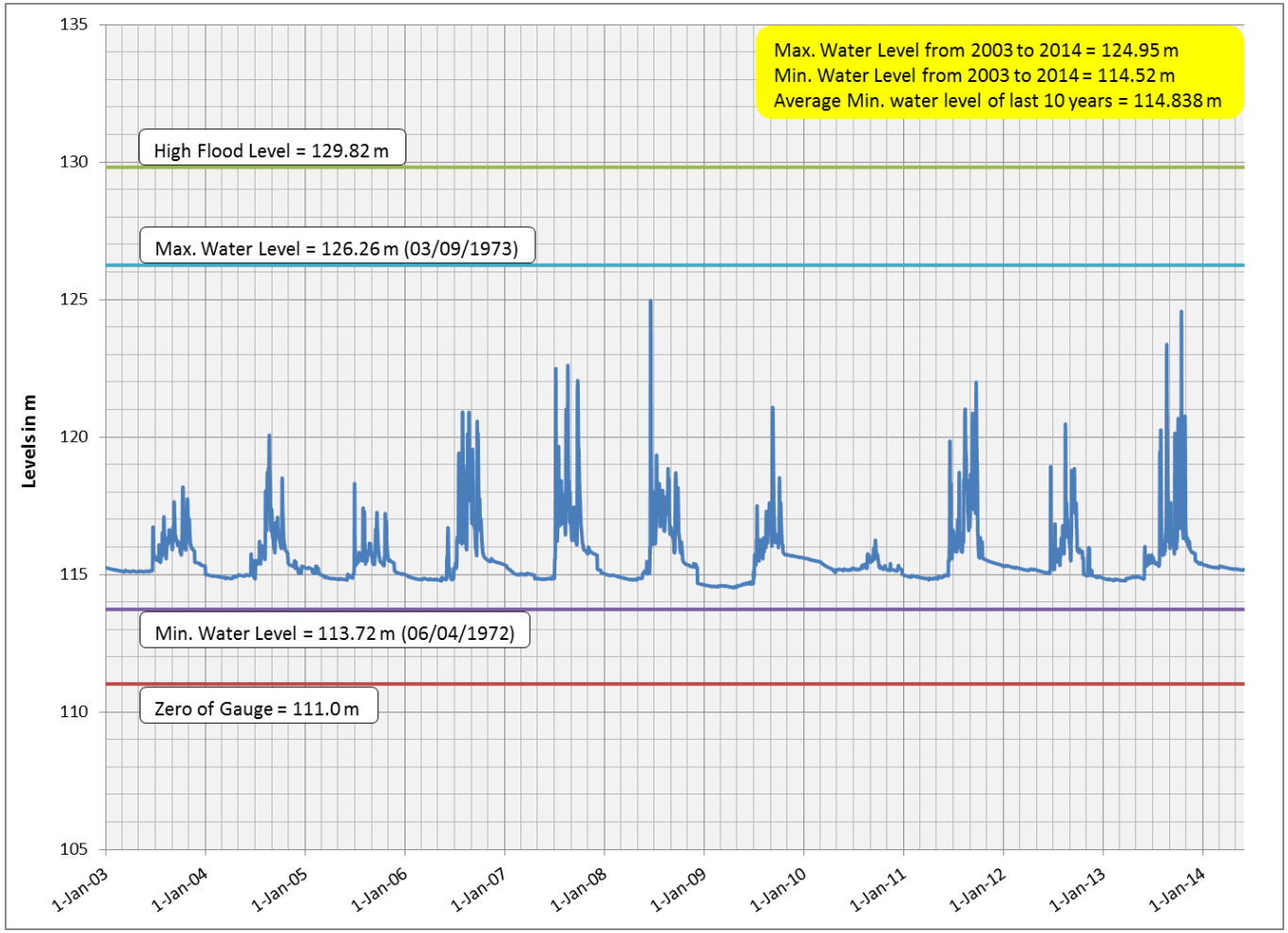


Figure 4: Water levels at Jamshedpur G&D site (Chainage 40 km from waterway start point, Chandil Dam)

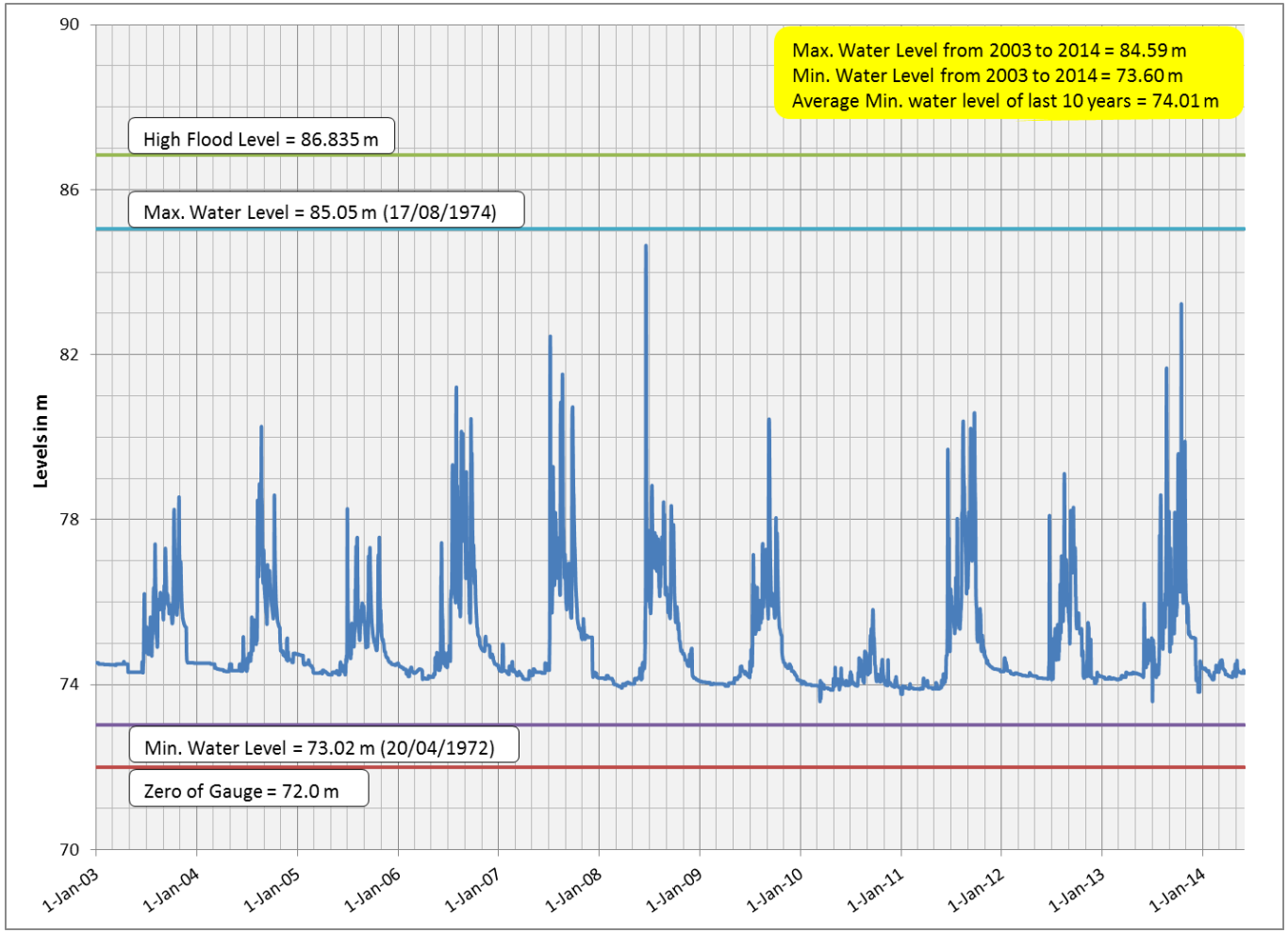


Figure 5: Water levels at Ghatsila G&D site (Chainage 87 km from waterway start point, Chandil Dam)

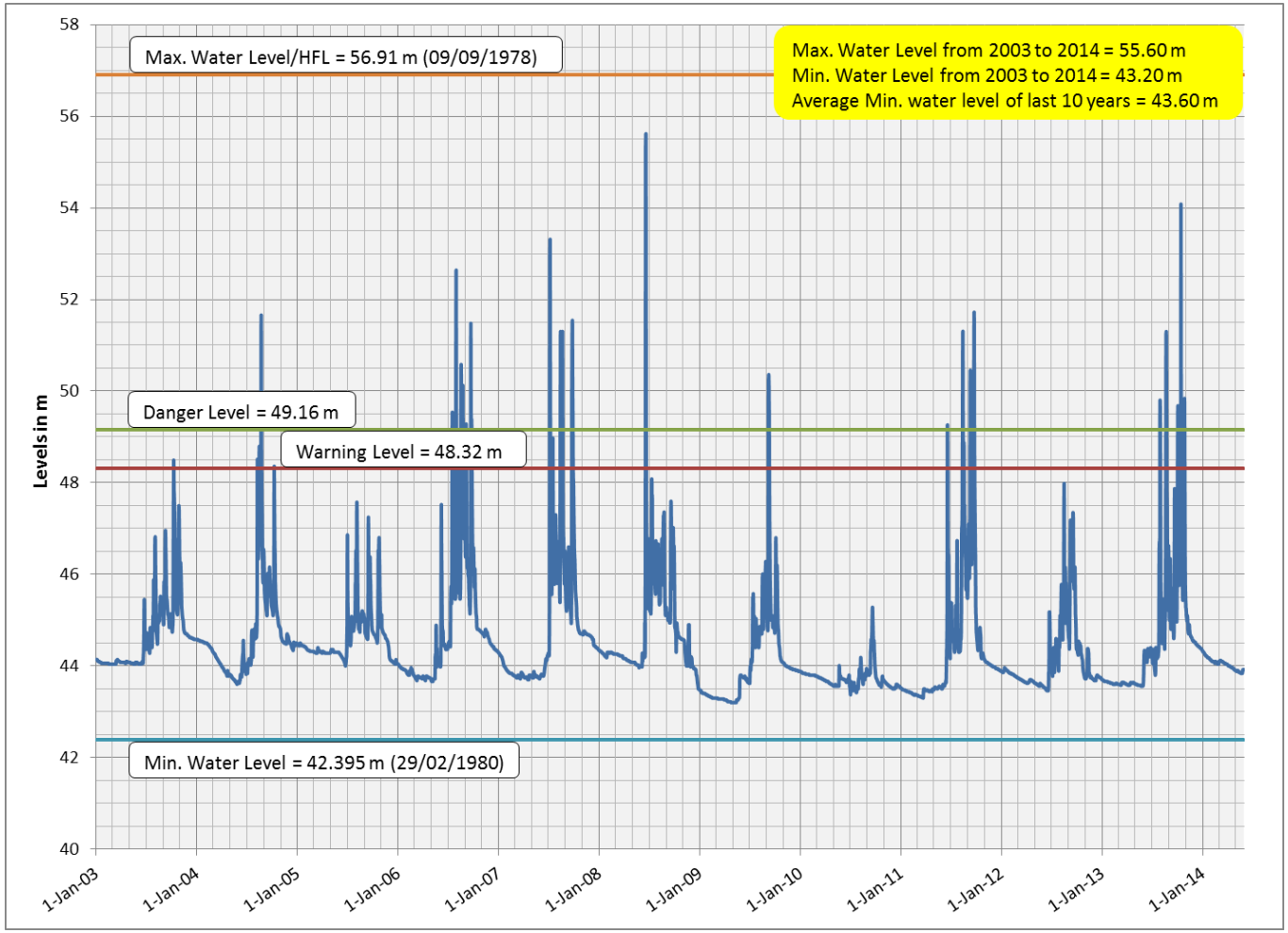


Figure 6: Water levels at Jamsholaghat G&D site (Chainage 147 km from waterway start point, Chandil Dam)

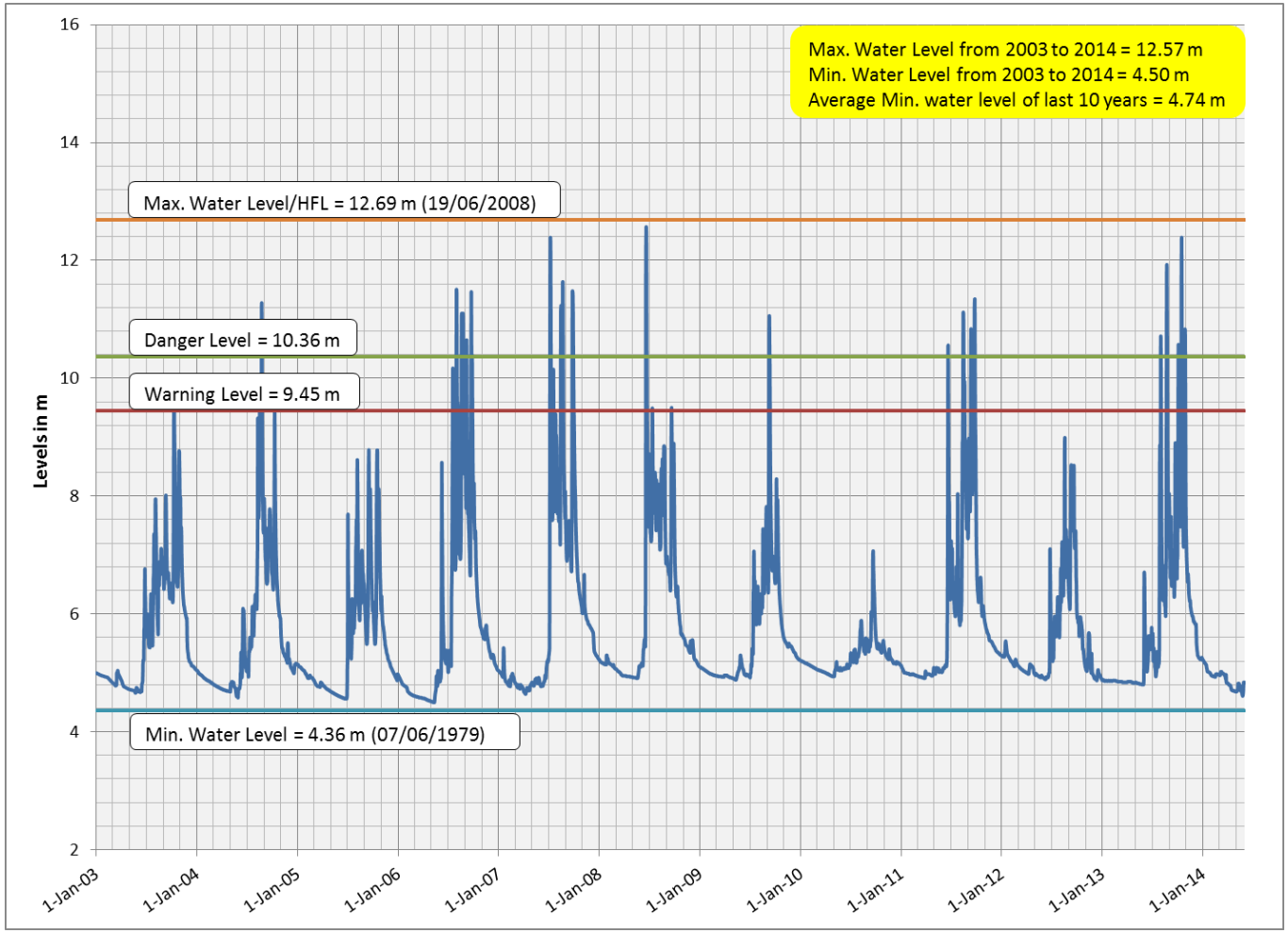


Figure 7: Water levels at Rajghat G&D site (Chainage 262.5 m from waterway start point, Chandil Dam)

From the above gauge data of 10 years (2003 – 2014) at four CWC G&D sites located along Subarnrekha waterway % duration of varying draft available above 10 years average of minimum gauge level is inferred as provided in **Table 5**.

Table 5: Draft available at G&D sites in last 10 years (2003 – 2014)

G&D Location	Duration	Zero of Gauge (m amsl)	Max Gauge level (m amsl)	Min. Gauge level (m amsl)	Average of Min. Gauge Level	% duration of draft available above 10 years average of min. Gauge level			
						< 1.0	1.0–1.5	1.5 –2.0	> 2.0
Jamshedpur (Chainage = 275 Km)	2003-2014	111.00	124.95	114.52	**114.838**	**31.00**	**11.42**	**10.96**	**46.62**
Ghatsila (Chainage = 227 Km)	2003-2014	72.00	84.59	73.60	**74.010**	**25.84**	**10.34**	**9.54**	**54.27**
Jamsholaghat (Chainage = 167 Km)	2003-2014	42.00	55.60	43.20	**43.602**	**25.25**	**8.08**	**8.08**	**58.59**
Rajghat (Chainage = 51.4 Km)	2003-2014	5.79	12.57	4.50	**4.738**	**28.15**	**9.82**	**10.31**	**51.72**

*m asml = meter above mean sea level.

The available discharges at Jamshedpur and Ghatsila G&D location are provided in **Table 6** below.

Table 6: Max, Min and Average Discharges at G&D sites in last 10 years (2004 – 2013)

Year	Jamshedpur G&D Site (chainage 275 Km)				Ghatsila G&D site (chainage 227 Km)			
	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with > Q_{avg}	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with > Q_{avg}
2004	3201.44	4.12	144.92	80	4000.00	7.70	155.29	82

Year	Jamshedpur G&D Site (chainage 275 Km)				Ghatsila G&D site (chainage 227 Km)			
	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with > Q_{avg}	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with > Q_{avg}
2005	1150.48	5.74	77.69	127	1602.19	5.11	98.85	87
2006	3319.68	6.80	263.73	84	4600.10	4.24	330.32	87
2007	3856.40	7.08	278.93	93	6060.56	14.50	381.31	93
2008	7382.00	4.50	290.68	112	9609.00	16.30	317.33	111
2009	3577.60	7.68	162.55	89	4191.58	21.40	239.40	106
2010	240.00	7.20	31.72	97	410.91	0.40	58.19	93
2011	4548.17	6.00	291.12	73	5580.27	20.12	424.08	95
2012	2020.00	7.16	145.54	93	2300.00	33.34	227.52	98
2013	8769.78	11.13	294.20	71	4886.27	16.94	283.62	105

6.0 ANALYSIS OF PRESENT STATE OF AFFAIRS

6.1 Existing Dams, barrage & Locks

There is one dam i.e. Chandil Dam at the starting point and one barrage i.e. Galudih Barrage between Jamshedpur and Ghatsila exist in the study area of Subarnrekha River.

Chandil Dam: Subarnrekha waterway start from the Chandil Dam as per the TOR. Following are the main features of Chandil Dam:

Sl. No.	Features	Details
1.	Dam Purpose	Multipurpose
2.	Dam Type	Earthen/ Gravity/ Masonry
3.	Max. Height above foundation	56.80 m
4.	Length of Dam	720.10 m
5.	Spillway Capacity	24,700 cumec
6.	Design Flood	29,680 cumec
7.	Maximum Water Level/ FRL	192.00 m
8.	Minimum Drawdown Level	180.00 m
9.	Live Storage Capacity	1,611 MCM
10.	Water allocation for Irrigation	750 MCM
11.	Water allocation for Drinking	44 MCM

Galudih Barrage: A barrage is also located at a chainage of about 76 km from Chandil Dam, constructed by Water resources department, Government of Jharkhand. The barrage comprises of one right bank canal which is used divert water from Subarnrekha River for irrigation.

6.2 Existing Bridges over Subarnrekha River

The existing bridges and crossings encountered during survey are listed in **Table 7**.

Table 7: Details of existing Major Road bridges over Subarnrekha River

Sl. No	Location	Chainage (km)	Easting	Northing	Vertical Clearance w.r.t. HFL (m)	Horizontal Clearance (m)
Major Road Bridges						
1	Kathapal	31.1	530118.3	2397544	7	10

Sl. No	Location	Chainage (km)	Easting	Northing	Vertical Clearance w.r.t. HFL (m)	Horizontal Clearance (m)
2	Rajghat	53.85	516937.8	2406842	12	9
3	Rajghat	53.85	516931.8	2406798	12	13
4	Basra Ghat	96.03	518760.9	2438331	10	7
5	Gopiballabhpur (SH9)	136.32	490144.9	2457132	10	11
6	Jamshola (NH6)	163.58	470501.7	2457209	10	9
7	Sham sundarpur	190.80	458831.5	2475016	10	6
8	Bihinda	200.32	456052.2	2481402	7	8
9	Derang	207.37	451567.1	2486252	8	10
10	Amainagar	224.13	446069.8	2496794	8	10
11	Benashol	227.75	443126.7	2498593	8	12
12	Benashol	227.98	442918	2498737	Broken Bridge	6
13	Luyabasa	258.44	429773.9	2518118	8	11
14	Lupungdih	262.62	428463.6	2520169	10	10
15	Jamshedpur	274.38	419020.7	2523563	10	18
16	Gouri	282.88	412189.6	2525642	8	9
17	Manikui	297.50	404405.4	2532562	10	8
18	Joida	308.50	398791	2538164	10	8
Rail Bridges						
1	Rajghat	54.15	516822.1	2407187	12.00 M	5.00 M
2	Rajghat	54.25	516820.3	2407235	12.00 M	5.00 M
3	Chadrarekha	238.58	436268.4	2505721	10.00 M	5.00 M

It can be inferred from the above table that the maximum and minimum horizontal clearance is in the range of **18.0 m to 5.0m**. Similarly the maximum and minimum vertical clearance is in the range of **12.0 m and 7.0 m** respectively.

6.3 Existing High Tension Lines and other cross structures

During the survey high tension lines are observed at certain chainages and the same is presented in the following **Table 8**.

Table 8: Details of Existing High Tension Lines

Sl. No	Location	Chainage (Km)	Easting	Northing	Vertical clearance w.r.t HFL (m)
1	Rajghat	54.35	516912.4	2406872	8.00 M
2	Gopiballabhpur	136.60	490062.1	2457280	8.00 M
3	Bhandariya	164.20	469823.9	2457553	8.00 M
4	Chhabisha	214.00	458821.5	2475037	8.00 M
5	Sonagara	214.60	435942.4	2506826	5.00 M
6	Bhadudih	294.60	406715.4	2531841	5.00 M
7	Bhadudih	294.70	406634	2531833	5.00 M
8	Bhadudih	294.80	406502.9	2531816	5.00 M
9	Manikui	298.00	403967.1	2532458	8.00 M
10	Katea	303.35	401292.2	2533790	8.00 M

6.4 Hindrances/ Encroachment along the Waterway

Along the waterway several hindrances/encroachments are encountered en-route the waterway, which are to be taken care before starting operations. These hindrances/encroachments are in the form of protruded rocks from the river bed, wooden and sand bridges. The list of these hindrances/encroachments is provided in

Table 9. Photographs of the listed hindrances/encroachments along the Subarnrekha waterway is provided in **Annexure 4**.

Table 9: Details of Hindrances / Encroachment along the Waterway

Sr. No.	Location	Chainage (km)	Easting	Northing
Protruded Rocks				
1	Narayanpur	171.55	471274.4	2457171
2	Sirsa	177.55	466387.9	2458969
3	Joti Pahari	189.65	464648.4	2467821
4	Shirbai	192.85	463174	2470610
5	Muthurkham	194.55	462159.6	2471646
6	Balijuri	196.05	460764.5	2472271
7	Ramasholi	215.35	452073.1	2485619
8	Chhabisha	223.05	447879.1	2489919
9	Jonbani	224.55	448668.2	2491091
10	Bagula	228.55	445670.5	2493626
11	Madnabera	261.05	429884.8	2514017
12	Luyabasa	265.85	429924.4	2518006
13	Nutandih	270.95	429884.8	2514017
14	Gautam Vihar	280.35	419923.3	2523187
Wooden Bridge				
1	Patna	58.55	518890	2409444
2	Baghabali	60.1	520536.7	2409752
3	Sonakania	73.65	526259.2	2418516
4	Sonakania	73.75	526231.2	2418704
5	Malpada (moya)	75.85	525327.1	2420412
6	Bilaspur	85.15	524002.5	2428130

Sr. No.	Location	Chainage (km)	Easting	Northing
7	Basra Ghat	100.05	518724.5	2438550
8	Phulboni	108.15	513494	2442966
9	Bidhyadharpur	121.65	505701.6	2450387
Sand Bridge				
1	Totapara	78.45	524812.8	2422535
2	Manikui	303.75	404760.6	2532551

6.5 Forest Area / Protected Area / Defence Area

Forests Area:

Subarnrekha waterway flows through the following districts comprising of forest area as detailed in **Table 10**.

Table 10: Forest Cover in Project districts

Districts	Geographical Area (Km^2)	Forest Cover (Km^2)			Total Forest	% of GA
		Very Dense	Moderate Dense	Open Forest		
East Sighbhum	3533	52	589	429	1070	30.29
Medinipur	14081	211	810	1973	2994	21.26
Balasore	3806	23	126	202	351	9.22

Source: India State Forest Report, 2015
Note: ***(i) Very Dense Forest:*** *All lands having tree canopy cover > 70%.*
(ii) Moderate Dense Forest: *Tree canopy cover between 40%-70%.*
(iii) Open Forest: *Tree canopy cover between 10%-40%*

Protected Area:

Subarnrekha River passes through the following protected areas:

Dalma Wildlife Sanctuary: Dalma wildlife sanctuary is about 15 km from the steel city Jamshedpur. This sanctuary attracts varied strata of people right from the city dwellers, students to nature lovers. The wildlife sanctuary runs parallel to the NH-33 with majestic hills as high as 900 ft. from mean sea level. Dalma Sanctuary is spread over 195 sq. km of forests of East Singhbhum and Saraikela-Kharsawan districts of the state of Jharkhand. The forests of Dalma, as classified by Champion and Seth come under the category Dry peninsular Sal (5B/C1) and Northern dry mixed deciduous forest (5B/C2). Most part of Dalma forests shed leaves in the summer and attains its full bloom at the onset of monsoon.

Dalma is otherwise known as paradise for elephant. The flagship species elephant count goes to 100 in number in the peak of summer where the waterholes deep inside the sanctuary quench their thirst. Recently brought four elephants are also one of the attraction points for the tourists. In past there used to be good number of deers in the sanctuary. With the decline in number of deers an enclosure was established with an object to breed in captivity and then release the excess deers into wild to regain the past glory. The deer enclosures at Makulakocha have spotted deers and sambhars. The enclosure is located in such a site that the spotted deers and sambhars sustain with the feeling of natural habitat.

Beside elephants there are Indian giant squirrel, sloth bear, barking deer, wild boar, porcupine, mouse deer, pangolin and mongooses in the sanctuary. Commonly seen birds in the sanctuary are the falcons, golden oriole, Indian tree pie, paradise fly catchers, grey hornbills, Indian peafowl, different varieties of kingfishers, herons, egrets, mynas, pigeons, racket tailed drongo, magpie robins etc.

Dumaria Hill Forest: Dumaria Hill Forest is along the one side of Subarnrekha River located in East Singhbhum district in the state of Jharkhand. It is about 60 km from the city of Jamshedpur.

6.6 Road and Rail Infrastructure

Subarnrekha waterway is well connected with rail and road network. The details of Railway station located within 5.0 Km radius of the waterway are presented in **Table 11** below:

Table 11: Railway station within 5.0 Km radius of Subarnrekha River

Sl. No.	Railway Station (within 5.0 km radius)	Sl. No.	Railway Station (within 5.0 km radius)
1.	Chandil Railway Station	8.	Galudih Railway Station
2.	Manikul Railway Station	9.	Ghatsila Railway Station
3.	Kunki Railway Station	10.	Dhalbhumgarh Railway Station
4.	Adityapur Railway Station	11.	Angua Railway Station
5.	Tatanagar Junction Railway Station	12.	Lakshannath Road Railway Station
6.	Govindpur Railway Station	13.	Jaleswar Railway Station
7.	Rakha Mines Railway Station	14.	Rajghat Railway Station

Detail of major roads connecting to the Subarnrekha waterway is provided in **Table 12**.

Table 12: Details of Major Road connected to Subarnrekha

Connecting Roads	
National/State Highway	**Other Major Roads**
a) National Highway 6 **b) National Highway 32** **c) National Highway 33** **d) National Highway 60** **e) State Highway 4** **f) State Highway 5** **g) State Highway 6** **h) State Highway 9** **i) State Highway 57** **j) State Highway 61**	a) Chandil Kandra Road b) Dimna Road c) Hali Gopi Road d) Basta Baliapal Road

7.0 RECONNAISSANCE SURVEY

The consultant done the reconnaissance survey as required for the feasibility studies and detailed as per TOR, as follows:

- Single line longitudinal survey (Bathymetric survey or Topographic survey) in the deepest depths or lowest height lands, with the help of DGPS using Automatic Hydrographic Survey System.
- Horizontal and vertical clearances above High Flood Level of bridges, aqueducts, electric lines, telephone lines, pipe lines, cables en-route are to be charted.
- Details about Barrages and Dams en-route are also to be reported.
- Topographical features of the Inland Waterways are to be reported.
- Typical physical features along the alignment i.e. land use pattern are to be reported
- Stretches having year round flow and critical depth for navigational purpose are to be reported.
- Preliminary Traffic on the Inland Waterways are to be identified.
- Inventory of major aspects including Inland Waterway width, Terrain, Bridges and structures across the Inland Waterways (Type, size and location) will be reported.
- Urban areas (location extent) are to be reported.
- Geologically sensitive areas environmental features are to be reported
- Hydrological features are to be reported.
- Critical areas requiring detailed investigations are to be reported.
- Requirements for carrying out supplementary investigations are to be reported.
- Visual inspection of Soil (textural classifications) are to be reported
- Major Drainage conditions are to be reported.
- Type and extent of existing utility services along the alignment are to be identified.
- Identification of various agencies of the govt. from whom the concerned project clearances for implementation are to be sought.

7.1 Detail Methodology for Survey

The surveyor deployed a team of personnel to carry out the reconnaissance survey; the detailed methodology is described in following sub sections.

7.1.1 Resource for Survey Work

Off shore Key Personal:

- Project in-charge: 1 no.
- Senior Surveyor: 4 nos.
- Survey Engineer: 3 nos.

On shore Key Personal:

- Project manager: 1 no.
- Survey manager: 2 nos.
- Reports Coordinator: 1 no.

Survey Equipment and Software:

Table 13: List of Equipment Mobilised for Survey

Survey Equipment/Systems Used for the Data Acquisition	
Equipment/System	**Description/Make/Model**
Software / Navigation	HYPACK 2015 computer acquisition and data logging Software
Positioning System	Trimble SPS 351(DGPS) & 855 RTK DGPS (One Base & Two Rover)
Single beam Echo Sounder	Sonar Mite
Tidal Observation	Valeport Automatic Tide Gauge/ Manual Tide Gauge
Levelling	Sokkia B40 Auto Level
Total Station	Trimble TS 635
Data Acquisition System	Dell laptop/ HP laptop

Survey Vessel

Considering the geographical and topographical feature, length of river, shallow and dry patch, inaccessibility to survey area, due to insufficient water for regular boat, inflatable Zodiac Boat "Aqua Marina-1", "Aqua Marina 2" were used to carry out bathymetric survey. The names and specifications of the survey boats are provided in **Table 14**.

Table 14: Details of Survey Boats Used

Name of the Boat	Length (m)	Width (m)	Draft (m)
Aqua Marina - 1	3.0	1.5	0.020
Aqua Marina – 2	2.5	1.29	0.020

7.1.2 Geodetic Parameters

The geodetic parameters used for survey were as follows:-

Global Positioning System Geodetic Parameters						
Datum:	World Geodetic System 1984 (WGS84)					
Spheroid:	World Geodetic System 1984					
Semi major axis:	a = 6 378 137.000 m					
Inverse Flattening:	$^1/_f$ = 298.257 223 563					
Local Datum Geodetic Parameters						
Datum:	World Geodetic System 1984 (WGS84)					
Spheroid:	World Geodetic System 1984					
Semi major axis:	a = 6 378 137.000 m					
Inverse Flattening:	$^1/_f$ = 298.257 223 563					
Datum Transformation Parameters from WGS84 to WGS84						
Shift dX:	0.0 m	Rotation rX:	0.000	arcsec	Delta Scale :	0.0000 ppm
Shift dY:	0.0 m	Rotation rY:	0.000	arcsec		
Shift dZ:	0.0 m	Rotation rZ:	0.000	arcsec		

Local Projection and Grid Parameters [2]	
Map Projection:	Universal Transverse Mercator
Grid System:	UTM Zone 45 N
Central Meridian:	087° 00’ 00” West
Latitude of Origin:	0° 00’ 00” North
False Easting:	500 000 m
False Northing:	0.0000
Scale factor on Central Meridian:	0.9996
Units:	metres

Notes:
1) Hypack navigation software always uses WGS84 geodetic parameters as a primary datum for any geodetic calculations.
2) This is the right-handed coordinate frame rotation convention used by the Hypack navigation software.

7.1.3 Survey Data Processing

General

The survey data was logged in HYPACK On-line Survey Software, and was processed using the HYPACK Processing, AUTOCAD and Spectra Precision Survey Office. The data was processed, checked and verified to ensure good quality data. Single Beam (SB) Editor was used for the automated and manual processing of logged data sets.

Navigation and Positioning

The DGPS Receiver Antenna was mounted exactly above the echo sounder transducer. The echo sounder transducer was mounted on the side of the boat, without any offset to ensure accuracy in the position of soundings. The bar-checks were carried out before/after each sounding session. Transducer draft was measured and recorded, and the same was used while processing. On all such occasions the error observed was zero or near zero. Therefore, no corrections were necessary.

Bathymetry

HYPACK Processing suite was used to import quality check and process the navigation, bathymetry and tidal data. The data was filtered, cleaned, and combined to create geographically positioned bathymetric data set.

7.2 Description of Bench Marks/ Reference Levels

During the execution of Survey work, temporary bench marks were established using static DGPS observation. This temporary bench mark was transferred using RTK Method. Details of the temporary bench marks, established by the surveyor at various locations along the Subarnrekha waterway are provided as shown in **Table 15**.

Table 15 : Temporary Benchmark Subarnrekha River

Sl. No.	TBM	Easting	Northing	Chainage (Km)	CD of TP wrt MSL (m)	Ht above MSL (m)
1.	Chandrabali	538849	2385565	3.843	-0.922	3.842
2.	Manunagar	532647	2396266	26.002	2.499	4.724
3.	Chakamadhab	523971.1	2400446	39.803	4.161	7.808
4.	Rajghat	516878.5	2406656	53.736	6.552	9.97
5.	Makarapur	525843.4	2417209	72.31	15.650	9.665
6.	Bhansra	519504.5	2439194	100.077	24.618	21.993
7.	Chuapal	505876.2	2450678	121.716	31.994	30.048
8.	Nayabasan	487085.7	2456324	149.208	40.983	39.345
9.	Jamsola	470570.2	2457133	172.321	46.791	44.249
10.	Maheshpur	464760.3	2460174	181.299	53.166	61.111
11.	Burujbani	458530.9	2479316	205.936	66.246	60.906
12.	Jonbani	448743	2490905	224.344	72.975	71.605
13.	Digri	438195.6	2504614	243.981	92.425	93.052
14.	Belajuri	433920.3	2514486	256.847	105.716	97.87

Sl. No.	TBM	Easting	Northing	Chainage (Km)	CD of TP wrt MSL (m)	Ht above MSL (m)
15.	Jamshedpur	418265.3	2523749	282.014	119.906	126.58
16.	Manikui	404399	2532666	304.031	145.14	140.753
17.	Ghoraling	399807.2	2540717	318.283	150.000	154.774

7.3 Levelling of Temporary Tide Poles

Seventeen Temporary Bench Marks were established in between the course of survey at different places by using Trimble RTK SPS 855. Auto level SOKIA B-30 was used to establish the zero of the tide gauge with reference the TBMs. The observed readings in Auto Level are provided in **Annexure 1**. The water levels observed on the tide poles during reconnaissance survey are provided in **Annexure 2**. Chart/Sounding datum established on the basis of levelling of tide poles is given in **Figure 8**.

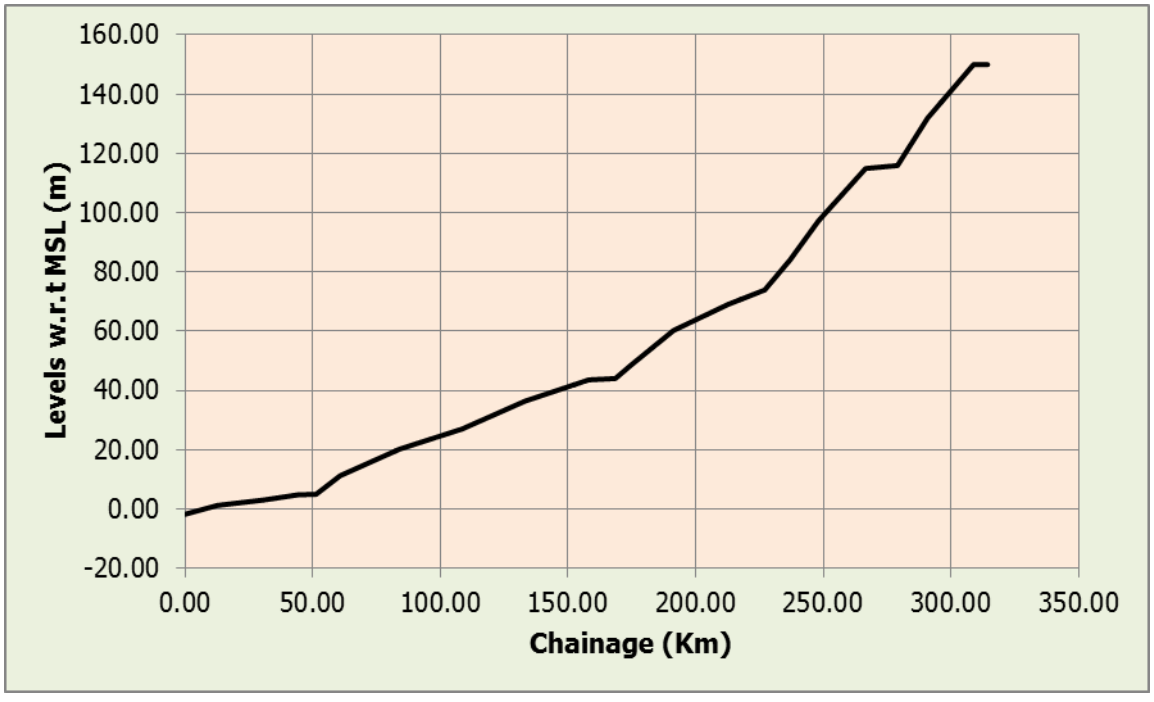


Figure 8: Graph showing Chart Datum/Sounding Datum w.r.t. MSL

7.4 Hydrographic Survey

Single line longitudinal survey Bathymetric survey in the deepest depths with the help of DGPS using Automatic Hydrographic Survey System has been carried out for the for the length of 314.0 km of Subarnrekha waterway except for about 2 Km of end stretch, where the topographic survey has been done.

7.5 Water Depth

Water depths along the waterway have been observed during Reconnaissance survey as per the scope of works and requirement for feasibility studies. Single line longitudinal bathymetric survey has been carried out for obtaining the water depth along the deepest route of waterway. The observed (raw) depth is then corrected with respect to Chart datum to obtain the reduced water depth. The reduced depth at every 10 km interval is presented in **Table 16**. The kilometre and stretch wise minimum and maximum reduced water depths are also furnished along with Digital Data and Charts respectively. Detailed observed and reduced water depths along the Subarnrekha Waterway are also presented in **Annexure 3**. Starting chainage of 0.0 Km is at confluence of Subarnrekha River with Bay of Bengal and end chainage is near Chandil Dam.

The observed (raw) water depth is corrected with respect to chart datum as provided in **Table 16**. Tidal reach of the river is from 0.0 Km chainage (i.e. confluence of the river with Bay of Bengal) to 40.0 Km upstream towards the Chandil Dam.

Table 16: Water Depth along the Waterway

Chainage (Km)	Draft Variation		Length of River (Km) with following draft w.r.t CD			
	Max. Available (m)	Min. Available (m)	<1m	1.0 -1.5m	1.5 -2.0 m	>2.0m
0 – 10	7.55	0.00	1.70	2.50	1.36	4.43
10 – 20	9.86	1.88	0.00	0.00	0.36	9.64
20 – 30	13.43	2.14	0.00	0.00	0.00	10.00
30 – 40	8.74	0.87	0.71	1.29	0.71	7.29
40 – 50	4.90	0.00	7.90	0.86	0.12	1.11

Chainage (Km)	Draft Variation		Length of River (Km) with following draft w.r.t CD			
	Max. Available (m)	Min. Available (m)	<1m	1.0 -1.5m	1.5 -2.0 m	>2.0m
50 – 60	7.50	0.59	0.59	0.40	0.89	8.12
60 – 70	6.95	0.92	0.51	1.22	2.04	6.22
70 – 80	5.29	0.72	1.48	5.19	1.30	2.04
80 – 90	2.62	0.80	1.06	3.62	2.55	2.77
90 – 100	5.47	2.36	0.00	0.00	0.00	10.00
100 – 110	5.39	1.62	0.00	0.00	1.59	8.41
110 – 120	4.28	1.50	0.00	0.00	7.06	2.94
120 – 130	2.81	1.39	0.00	3.75	4.20	2.05
130 – 140	5.81	1.36	0.00	0.75	2.39	6.87
140 – 150	5.84	3.24	0.00	0.00	0.00	10.00
150 – 160	9.68	0.00	1.45	0.00	0.00	8.55
160 – 170	15.97	0.00	5.71	1.07	0.36	2.86
170 – 180	6.90	0.00	7.30	0.27	0.81	1.62
180 – 190	4.49	0.00	3.78	1.34	0.39	4.49
190 – 200	4.10	1.13	0.00	3.17	2.81	4.03
200 – 210	3.30	1.03	0.00	5.13	2.82	2.05
210 – 220	5.29	0.84	0.59	1.76	1.32	6.32
220 – 230	10.86	0.33	1.37	0.40	0.08	8.15
230 – 240	14.60	0.00	5.06	0.91	0.78	3.25
240 – 250	7.32	0.06	1.70	1.48	2.16	4.66
250 – 260	7.15	1.20	0.00	1.16	2.91	5.93

Chainage (Km)	Draft Variation		Length of River (Km) with following draft w.r.t CD			
	Max. Available (m)	Min. Available (m)	<1m	1.0 -1.5m	1.5 -2.0 m	>2.0m
260 – 270	4.63	1.46	0.00	0.52	2.76	6.72
270 – 280	3.74	0.00	2.75	1.45	1.59	4.20
280 – 290	4.82	0.60	1.31	0.66	1.15	6.89
290 – 300	5.23	1.17	0.00	0.83	2.86	6.32
300 – 310	6.49	0.00	3.07	2.29	1.79	2.86
310 – 314	9.78	0.00	2.35	0.12	0.12	1.41
Total			**50.42**	**42.12**	**49.27**	**172.19**

It can be inferred from the above table that **172.19 km stretch of waterway have draft of more than 2.0 m, 49.27 Km stretch have draft of 1.50 m to 2.0 m, 42.12 km have draft of 1.0 m to 1.50m and remaining 50.42 km stretch of waterway have less than 1.0 m draft** respectively.

7.6 Soil Characteristics

On the basis of visual assessment done during longitudinal survey, the characteristics of soil on both banks of the waterway are provided in **Table 17**.

Table 17: Soil Characteristics along Subarnrekha River

S. No.	Chainage (Km)	Latitude	Longitude	Easting (m)	Northing (m)	Analysis
1	0	21°33'28.75"N	87°22'58.60"E	539647.59	2383962.23	Soft sand
2	10	21°35'47.37"N	87°18'13.40"E	531438.55	2388196.01	Soft sand
3	20	21°39'14.25"N	87°19'39.03"E	533887.01	2394561.56	Soft sand
4	30	21°40'57.36"N	87°16'57.83"E	529248.23	2397722.69	Soft sand
5	40	21°42'47.11"N	87°12'42.68"E	521911.78	2401085.22	Sand

S. No.	Chainage (Km)	Latitude	Longitude	Easting (m)	Northing (m)	Analysis
6	50	21°45'27.34"N	87°10'31.17"E	518127.92	2406006.59	Pebbles & sand
7	60	21°48'11.27"N	87°12'58.16"E	522342.49	2411052.13	Muddy sand
8	70	21°51'35.08"N	87°15'01.26"E	525866.79	2417323.79	sand
9	80	21°56'16.12"N	87°14'30.43"E	524968.26	2425963.26	Pebbles & sand
10	90	22°00'07.56"N	87°12'33.76"E	521611.90	2433074.28	Muddy sand
11	100	22°04'07'.45"N	87°10'06.72"E	517387.89	2440444.71	Muddy sand
12	110	22°07'30.05"N	87°07'18.91"E	512573.56	2446669.40	Muddy sand
13	120	22°09'54.22"N	87°02'58.40"E	505109.19	2451097.86	Muddy sand
14	130	22°12'20.09"N	86°59'14.22"E	498689.39	2455582.08	Muddy sand
15	140	22°12'21.08"N	86°54'41.64"E	490885.02	2455584.68	Sand
16	150	22°12'35.25"N	86°51'01.76"E	484590.16	2456055.79	Sand
17	160	22°12'09.96"N	86°47'41.50"E	478855.69	2455285.03	Soft sand
18	170	22°13'12.62"N	86°42'51.11"E	470545.12	2457225.11	Rocky sand
19	180	22°15'18.52"N	86°39'42.68"E	465159.03	2461107.78	Rocky sand
20	190	22°20'08.68"N	86°38'39.06"E	463359.34	2470033.07	Rocky sand
21	200	22°23'51.92"N	86°34'53.31"E	456920.75	2476913.00	Rocky sand
22	210	22°27'22.39"N	86°33'09.00"E	453957.54	2483394.13	Rocky sand
23	220	22°30'45.38"N	86°29'15.63"E	447308.96	2489657.15	Rocky sand
24	230	22°34'36.05"N	86°28'36.38"E	446212.53	2496753.86	Rocky sand
25	240	22°38'13.05"N	86°24'35.87"E	439371.06	2503452.22	Rocky sand
26	250	22°42'18.44"N	86°22'44.62"E	436227.11	2511010.91	Rocky sand
27	260	22°44'23.15"N	86°18'38.71"E	429228.90	2514876.81	Rocky sand

S. No.	Chainage (Km)	Latitude	Longitude	Easting (m)	Northing (m)	Analysis
28	270	22°47'57.97"N	86°17'11.68"E	426778.46	2521494.45	Rocky sand
29	280	22°49'03.46"N	86°12'02.94"E	417987.12	2523553.16	Rocky
30	290	22°50'42.42"N	86°07'55.22"E	410943.04	2526636.17	Rocky
31	300	22°53'34.71"N	86°04'55.27"E	405847.26	2531965.66	Rocky
32	310	22°55'54.73"N	86°01'01.32"E	399210.03	2536314.66	Rocky
33	314	22°58'29.34"N	86°01'14.03"E	399632.45	2540915.43	Rocky

7.7 Tidal Waterway Section

It is seen from the data collected during Reconnaissance survey that out of 314 Km of the Subarnrekha waterway section, about 40 Km of stretch from the river confluence with Bay of Bengal have Tidal influence. The tidal variation of 1.7 m is observed.

8.0 MARKET ANALYSIS

Preliminary market analysis has been done on the basis of reconnaissance survey, Consultants site visit, available secondary informations and published literature at the feasibility stage of the project.

8.1 Land Use Pattern

Land use pattern along the Subarnrekha River can be characterized as Agricultural and Residential as presented in **Table 18**.

Table 18: Land Use Pattern along Waterway

Length (Km)	Agricultural		Residential	
	Length (Km)	%	Length (Km)	%
314	254.3	81%	59.7	19%

8.2 Crops /Agriculture products

Subarnrekha waterway is located along the following districts of Jharkhand, West Bengal and Odisha, namely;

- Saraikela Kharsawan
- East Singhbhum
- Paschim Medinipur
- Balasore

The details of cropping system in the above listed districts are as follows:

Saraikela Kharsawan: In Sarikela - Kharsawan district Agricultural production is characterized by mono cropping practices with only 10% of the net cropped area being irrigated. Paddy is the predominant crop under mono cropping system. Paddy is cultivated predominately in the district. Besides Maize, pulses and oil seeds are also cultivated on seasonal basis. The predominant activity other than paddy and maize are cultivated in various blocks. Sawai grass, cultivated in Jagannathpur, Tonto, Rajnagar and Ichagarh blocks Tasar silk in Kuchai, Kharsawan, Rajnagar, and Gamharia blocks & Lac in Kuchai, Kharsawan, Chandil, Ichagarh and Nimdih blocks. In some pockets of Rajnagar, saraikela, Kuchai, Ichagarh, Gamharia, Chandil and Nimdih blocks fruits such as Papaya, Jack fruit, Custard apple and Guava are grown. However in some pockets vegetable, fruits crops are also grown

but to a limited extent. Agriculture is not only an important driver of macro- economic performer; it is an essential element of the strategy to make growth more inclusive. The productivity of major food grains is less than the State average and also farmers are discouraged to grow other crops due to lack of processing, marketing, technology etc. The district is also rich in various produces such as Amla, Chironji, Mahua and Sawai Grass.

Table 19: Average Production and Productivity of major crops in Saraikela district (2004-09)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Rice	116.9	1513	-	-	-	-	116.9	1513
Maize	2.6	1290	0.6	1350	-	-	3.2	1320
Pigeonpea	1.7	500	-	-	-	-	1.7	500
Blackgram	3.5	445	-	-	-	-	3.5	445
Greengram	0.4	415	-	-	-	-	0.4	415
Wheat	-	-	1.4	1600	-	-	1.4	1600
Chickpea	-	-	0.5	1400	-	-	0.5	1400
Pea	-	-	0.2	1500	-	-	0.2	1500
Lentil	-	-	0.1	750	-	-	0.1	750

Source: Agriculture Contingency Plan

East Singhbhum: The main cereals grown in the district are paddy, maize, ragi, wheat, barley, bajara and jowar. The cultivation of pulses includes gram, arhar, kulthi, urad, pea, khesari, masoor, moong and some other pulses too. Among oilseeds, groundnut, rape mustard, linseed, sarguja, til and sunflower are cultivated. Cash crops like sugar cane,cotton, castor and jute in the district are not cultivated. But green vegetables in the district are widely cultivated. The seasonal vegetables like tomato, cabbage, cauliflower, potato, brinjal, ladies finger, chill,pomkin,sponge gourd, bitter gourd, ridge gourd and onion etc. are cultivated on a very large scale. The fruit orchard in the district include banana, mango, guava, lemon,popaya. The average rainfall is 1150 mm to 1250 mm, which is conducive for production of vegetables. However, there is urgent need for increasing the irrigation coverage in the district so that mono cropping at present may be transformed to multi cropping

system in future.Tomato, cauliflower and brinjal are supplied to other states like Orissa and West Bengal. The climate in East Singhbhum is suitable for selective cultivation of some of the medicinal plants as well as aromatic plants. Initiative has been taken by a few entrepreneurs in the district for cultivation of Safed Musli, Stevia, lemon grass and Satawar. Brahmanand Farms Ltd has taken 50 acres of land on lease from Zonal Research Station, Darisahi (under Birsa Agriculture University) and is cultivating various medicinal plants to give demonstrative effects. The climate in East Singhbhum is also suitable for cultivation of Jatropha plants on the wasteland and barren forest land. Potential for Jatropha may be tried with assured distillation and marketing support to the producing farmers.

Table 20: Average Production and Productivity of major crops in East Simbhum district (2004-08)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Maize	3.2	1093	0.5	1704	-	-	3.7	1398
Pigeonpea	1.3	750	-	-	-	-	1.3	750
Blackgram	0.9	677	-	-	-	-	0.9	677
Greengram	0.5	790	-	-	-	-	0.5	790
Wheat	-	-	2.3	1295	-	-	2.3	1295
Chickpea	-	-	0.5	985	-	-	0.5	985
Pea	-	-	0.2	804	-	-	0.2	804
Lentil	-	-	0.1	494	-	-	0.1	494
Mustard	-	-	0.4	243	-	-	0.4	243

Source: Agriculture Contingency Plan

Paschim Medinipur: The district is primarily agricultural in nature, with cultivation being the chief livelihood of a majority of the people. Paddy occupies the first place in production. The district has a suitable agro-climatic condition for cultivation of mulberry and horticulture crops such as mango, banana, guava, lemon, mousambi, papaya, cashew and jackfruit. The district is well known for the production of mulberry and tussar silks, and Silk saris from Midnapore are much in demand.

Table 21: Average Production and Productivity of major crops in Paschim Medinipur district (2004-08)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Rice	84.33	2063	1205.30	2505	452.29	3156	1742.42	7724
Wheat	-	-	17.68	2141	-	-	17.68	2141
Jute	66.29	2845	-	-	-	-	66.29	2845
Pulses	-	-	4.33	659	-	-	4.33	659
Oilseeds	-	-	102.47	1055	-	-	102.47	1055
Potato	-	-	1412.56	19484	-	-	1412.56	19484

Source: Agriculture Contingency Plan

Balasore: The major crops of the district are paddy, ground nut, mustard, mung, biri and vegetables which are widely covered in the district for both kharif and rabi season.

Table 22: Average Production and Productivity of major crops in Balasore district (2004-08)

Name of Crop	Kharif		Rabi		Summer		Total	
	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)	Production ('000 t)	Productivity (kg/ha)
Major Field Crop								
Paddy	415.01	1963	109.73	3220	-	-	524.74	2137
Maize	0.37	1156	0.10	1205	-	-	0.47	1166
Mung	0.04	515	3.20	425	-	-	3.24	426
Biri	0.12	527	3.36	505	-	-	3.48	506
Oilseeds	-	-	102.47	1055	-	-	102.47	1055

Source: Agriculture Contingency Plan

8.3 Availability of Passenger Ferry Services

Passenger ferry services are located near Jamshedpur and near river confluence with Bay of Bengal during Reconnaissance survey. The ferry services locations along Subarnrekha River are given in **Table 23**.

Table 23: Existing Ferry locations along Subarnrekha River

Sl. No	Location	Chainage (Km)	Easting	Northing
1	Chandrabali	3.85	538871.03	2385570.58
2	Majhi Basti, Jamshedpur	286.85	413882.56	2525628.47

8.4 Existing Jetties and Terminals

Only one Jetty is available along the Subarnrekha River as given in **Table 24**.

Table 24: Existing Jetty and Terminal locations

Sr. No.	Description	Location	Chainage (Km)	Easting	Northing
1	Fishing Jetty	Chandrabali	1.5	538940.68	2385571.51

8.5 Prominent places along the Subarnrekha River

The Subarnrekha basin extends over States of Jharkhand, Odisha and comparatively smaller part in West Bengal having a total area of 29,196 Sq.km. Situated in the north-east corner of the Peninsular India, the basin is bounded by the Chhotanagpur plateau on the north and the west, by the ridges separating it from Baitarani basin on the south, by the Bay of Bengal on the south-east and by the Kasai Valley of Kangsabati River on the east. The Subarnrekha and the Burhabalang forms the major river systems in the basin. The waterway is of 314 km starting from Chandil Dam to confluence with Bay of Bengal. The following prominent City /Town falls along the Subarnrekha waterway:

Chandil: Chandil is a census town in Seraikela Kharsawan district in the state of Jharkhand, India. The natural scenery in and around Chandil is unique and enchanting. It is surrounded by green mountains, hills, streams, rivers, the peace, pleasure and knowledge providing gifts of God, the Almighty on all sides.

Jamshedpur: Jamshedpur is a city located in the state of Jharkhand in India founded by the late Jamshedji Nusserwanji Tata as Sakchi. In 1919 Lord Chelmsford named it Jamshedpur, in honour of its founder. It is located on the Chota Nagpur plateau and is surrounded by the picturesque Dalma Hills. The city is bordered by the rivers Subarnrekha and Kharkai on the north and west parts of the city.

Ghatshila: Ghatshila is a town in east Singhbhum district in the state of Jharkhand, India. The city is located on the bank of the Subarnrekha River, and it is situated in a forested area. Ghatshila was formerly the headquarters of the kingdom of Dhalbhum.

Dhalbhumgarh: Dhalbhumgarh is a small town, it is sitiuated near forest and a block headquarters in East Singhbhum District of Jharkhand. It is located about 60 km south of Jamshedpur.

Baharagora: Baharagora is a small town in East Singhbhum district and situated on the south-east corner of Jharkhand, India. It is approx. 100 km from Jamshedpur & 200 km from Kolkata. Baharagora became a block in the year 1956. It is located at the southern end of Jharkhand. Baharagora is the entry point of Jharkhand from the two states, namely West Bengal and Orissa. Baharagora is located at 22.28°N 86.72°E. It has an average elevation of 79 m. The river Subarnrekha flows along its adjoining areas.

Gopiballabhpur: Gopiballabhpur is a town in Jhargram Taluk of Paschim Medinipur district in the state of West Bengal along Subarnrekha River.

Jaleshwar: Jaleswar is a small town that belongs to Balasore district of state Odisha and is adjacent to border of West Bengal.

8.6 Historical and tourist place along the waterways

Following important historical and tourist place are located along the Subarnrekha River waterway:

Jamshedpur: Jamshedpur is the most populous Urban Agglomeration in the Indian state of Jharkhand and the headquarters of the East Singhbhum district of Jharkhand. It is located on the Chota Nagpur plateau and is surrounded by the picturesque Dalma Hills. The city is bordered by the rivers Subarnrekha and Kharkai on the north and west parts of the city. Jamshedpur though being primarily an Industrial city has also started to attract tourists. It has the benefit of being near a hill and forest range hence it serves as a nodal point for all the further destinations. Some of the major tourist attractions of the city are Jubilee Park which was a gift by Tata Steel to the citizens of Jamshedpur on the completion of its 50 years. Dimna Lake is an artificial reservoir and one of the

main sources for the city's drinking water. Dalma Hills are north of the Subarnarenkha River, which stretch 16 km from east to west. The other important ones are Tata Steel Zoological Park, Chandil Dam, Rivers Meet, Hudco Lake, Centre for Excellence (CE), Sir Dorabji Tata Park, Moolgaokar Park, Bhuvneswari Temple and others.

Ghatshila: Ghatshila is a town in east Singhbhum district in the state of Jharkhand, India. The city is located on the bank of the Subarnrekha River, and it is situated in a forested area. Ghatshila was formerly the headquarters of the kingdom of Dhalbhum. Royal family of the Kingdom of Dhalbhum had originated from the north–west (Dhara and Mandu), located at the border of Rajasthan. They established themselves by conquest in western part of Bengal, the area commonly known as Jungle Mahals. These families kept up a sort of semi–royal state and dignified their heir–apparent and those in immediate succession with title of honor, which denotes precedence. Thus, in the Dhalbhum family, the oldest son of the ruling king (Rajah) took the title of Jubraj, the second that of Hikkim, the third of Barathakur, the fourth that of Kuar, the fifth that of Musib and the rest Babu. The area of the kingdom of Dhalbhum was approximately 1,200-square-mile (3,100 km2). Raja Jaganath constructed the Rankini Mandir at Galudih. But due to some problem, he shifted the Kali temple along with all the associates and other people to Ghatsila and built up a temple of goddess Kali, which is known as Rankini Mata. Ghatshila is blessed with scenic beauty as it is located between two mountain ranges. River Subarnrekha separates the two ranges and it is a mesmerising view to see the nature's wonder. An aerial view of Ghatshila will look like a rocky landscape with flowing river along with meagre human habitat at certain places. Panch Pandav situated 5 km North West of Ghatshila bears mythological importance. The Pandavas are carved out on stone at Panch Pandav. Apart from these, enthusiasts can also explore Burudi Lake, Rankani Temple, Dharagiri Falls, Naroa Forest, Surda Pahar and Mosaboni Copper Mines. Galudi is another attractive tourist spot located on the bank of river Subarnrekha. Dalma Range of Moubhandar is a unique spot of Ghatshila.

Chandil: Chandil is a census town in Seraikela Kharsawan district in the state of Jharkhand, India. The natural scenery in and around Chandil is unique and enchanting. It is surrounded by green mountains, hills, streams, rivers, the peace, pleasure and knowledge providing gifts of God, the Almighty on all sides. Chandil Dam standing on the Subarnrekha River is a place of scenic beauty. This dam is one of the most visited places of Jharkhand. The museum located close to the Chandil dam has scripts written on rocks, which are 2000 years old. The multi-purpose Chandil dam was built across the meeting place of both the rivers. The dam is 220 meter in height and the height of its water level is 190 meter from different places tourists coming from different parts of the country enjoy boating and the natural beauty in and around the dam. Chandil is famous for its importance in the field of tourism. The River Subarnrekha flows through this region. The Karkori River originating

from the Hundru falls mingles with the Subarnrekha River at Chandil. The other tourist attractions are Jayda Temple, Sai Baba Temple, Mathia Temple and Dalma Wildlife Sanctuary.

8.7 Availability of Construction Material

Major construction materials available along the Subarnrekha River are Sand and Bricks. Rocks are also available along the bed and banks of Subarnrekha River in some stretches.

8.8 Industries along the waterway

Number of Industries exists along the bank of Subarnrekha River waterway. The well-known Industries are Tata Iron and Steel Company (TISCO) and Hindustan Copper Limited (HCL). Some important small scale industries in the basin are tobacco products in Chakradharpur, cement, asbestos sheets, glass and ceramics at Chaibasa. Locomotives and coaches, automobiles, agricultural equipment, wires and cables, iron and steel machinery, metal tubes and conduits, copper and brass, chemicals (acids) and caustics, fertilizers and Soaps at Jamshedpur. The important minerals found in the basin are copper, uranium, chromium, gold, vanadium, limestone, dolomite, asbestos, china clay, talc and building stones besides iron and aluminum. Apart from these there are several Brick kiln present along the Subarnrekha River.

The likely exportable items are follows:

1) Tobacco Products
2) Glass and Ceramic Product
3) Cement
4) Fresh water Fish
5) Agriculture products
6) Iron and Steel Machinery
7) Copper and Aluminium

8.9 Existing water sport and recreational activities and future probability

Water recreational activities are available at Chandil. The lake is often intercepted by a whizzing speed boat or by a lazy shikara.

8.10 Estimated Cargo movement

Existing passengers and cargo movements are located along Subarnrekha River. Inland waterways mode of transport has immense potential for domestic cargo transportation as well as for cruise, tourism and passenger traffic. A short traffic survey was also carried out over the bridges on Subarnrekha in Jamshedpur as provided in **Table 25**.

Table 25: Traffic Density over Mango Bridge in Tatanagar

Sl.no.	Vehicle make	No. of Vehicles	
		From Tatanagar to Payal cinema Date 16/03/2016 Time :12:00 hrs to 13:00 hrs	From Payal cinema to Tatanagar Date 16/03/2016 Time :13:00 hrs to 14:00 hrs
1	Bike	4272	4020
2	Auto	804	696
3	Car	564	492
4	Dalla auto	96	228
5	Chotta hathi	192	168
6	Mini Truck	96	132
7	Bus	72	48
8	Others Rickshaw / cycle / Cycle dalla etc	876	771
	Total	**6972**	**6555**
***At the time of monitoring there was "No entry" for trucks**			

Subarnrekha waterway has huge potential for economic development considering its connectivity with Jamshedpur, one of the biggest industrial city of India, its confluence with Bay of Bengal directly and its length as compared with other National Waterways.

Forecasted cargo potential has been estimated on the basis of last 13 year growth pattern of Cargo movement from 2002-2003 to 2014 – 2015 for National waterway-1, as provided in the IWAI Annual

reports. Linear correlation between existing and declared National Waterways has been done, to estimate the forecasted cargo potential. In Stage-I of the study a base figure of 0.0 tonnes cargo movement is assumed for estimating the forecasted figures as shown in **Figure 9**.

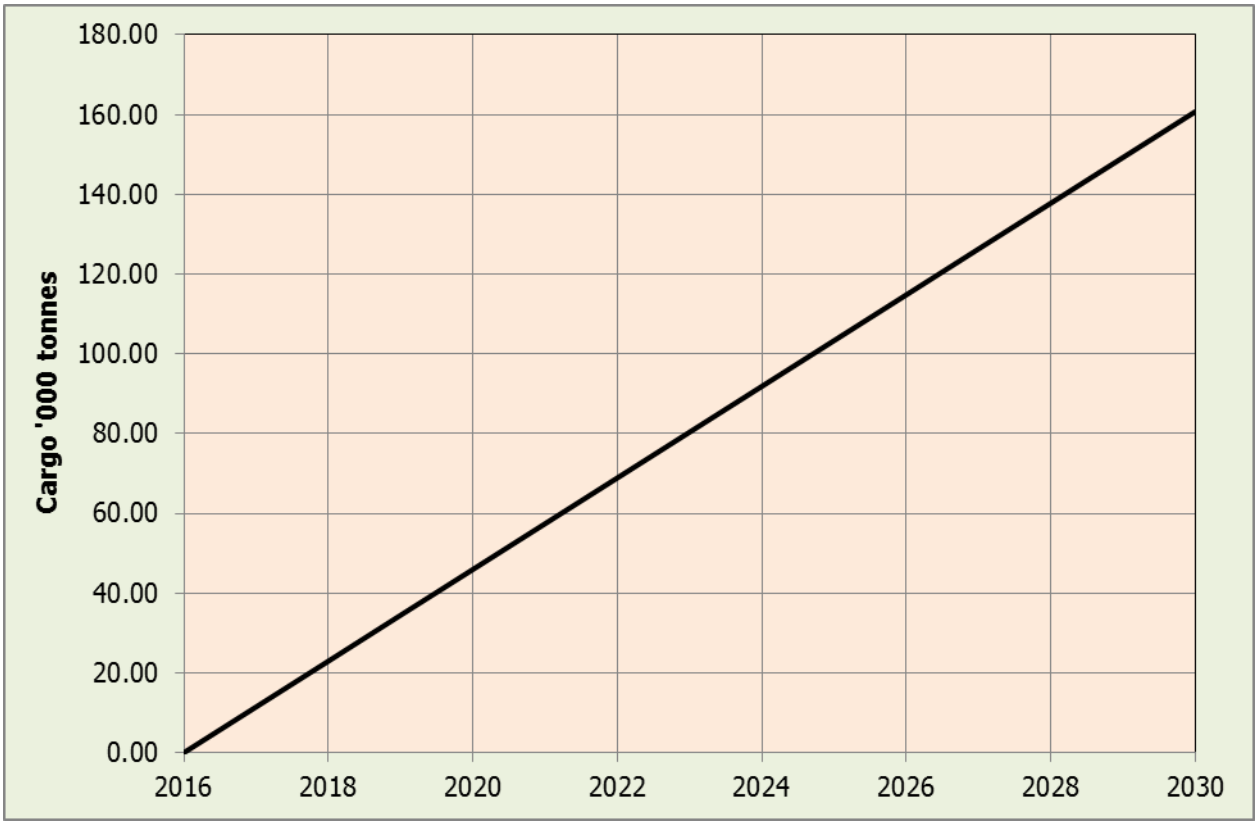


Figure 9: Forecasted Cargo Potential

Prima facie Subarnrekha waterway has huge economical potential for development of Inland waterway. Not only there is existing traffic but also the development of waterway will trigger new traffic. Extent of development and prioritisation of inland waterways will be prepared in subsequent phase of the DPR study.

9.0 OBSERVATION AND INFERENCE

On the basis of reconnaissance survey as well as primary and secondary data collected from IWAI, central and state government departments and other stakeholders, following observations and inferences are made on the Subarnrekha River (National Waterway 96).

9.1 Waterway

Subarnrekha River flows through the Indian states of Jharkhand, West Bengal and Odisha. After originating near Piska/ Nagri, near Ranchi, the capital of Jharkhand, the Subarnrekha traverses a long distance through Ranchi, Seraikela Kharsawan and East Singhbhum districts in the state. Thereafter, it flows for shorter distances through Paschim Medinipur district in West Bengal for 83 kilometres and Balasore district of Odisha. There, it flows for 79 kilometres and joins the Bay of Bengal near Talsari. The total length of the river is 395 kilometres. The basin of the Subarnrekha is smaller than most multi-state river basins in India. The rain-fed river covers a drainage area of 18,951 square kilometres. The total catchment area of Subarnrekha river is 3, 581 sq.km.

The important tributaries on the right bank of this river are Kanchi and Kharkai which meet Subarnrekha above Chandil dam and another right bank main tributary named as Kharkai meets this river near Jamshedpur upstream of Galudi barrage. Dulung is the main tributary which joins Subarnrekha from its left in the Paschim Medinipur district of West Bengal.

9.2 Least Available Depth (LAD)

LAD of <1.0 m, 1.0 m to 1.5 m, 1.5 m to 2.0 m and >2.0 m available at four G&D locations (Refer **Table 5**) are again re-produced in **Table 26** as below:

Table 26: Draft available at G&D sites in last 10 years (2003 – 2014)

G&D Location	Duration	Zero of Gauge (m amsl)	Max Gauge level (m amsl)	Min. Gauge level (m amsl)	Average of Min. Gauge Level	% duration of draft available above 10 years average of min. Gauge level			
						< 1.0	1.0–1.5	1.5 –2.0	> 2.0
Jamshedpur (Chainage = 275 Km)	2003-2014	111.00	124.95	114.52	**114.838**	**31.00**	**11.42**	**10.96**	**46.62**

G&D Location	Duration	Zero of Gauge (m amsl)	Max Gauge level (m amsl)	Min. Gauge level (m amsl)	Average of Min. Gauge Level	% duration of draft available above 10 years average of min. Gauge level			
						< 1.0	1.0–1.5	1.5 –2.0	> 2.0
Ghatsila (Chainage = 227 Km)	2003-2014	72.00	84.59	73.60	**74.010**	**25.84**	**10.34**	**9.54**	**54.27**
Jamsholaghat (Chainage = 167 Km)	2003-2014	42.00	55.60	43.20	**43.602**	**25.25**	**8.08**	**8.08**	**58.59**
Rajghat (Chainage = 51.4 Km)	2003-2014	5.79	12.57	4.50	**4.738**	**28.15**	**9.82**	**10.31**	**51.72**

*m asml = meter above mean sea level.

It can be inferred from the above table that > 2.0 m draft (above average min. of 10 years gauge level) is available about or more than 50% of time in last 10 years from 2003 to 2014. Also about 70% of time in those 10 years the draft is > 1.0 in Subarnrekha Waterway up-to Jamshedpur.

In addition to above the LAD on the Subarnrekha waterway is also estimated on the basis of applying exceedance probability approach on the reduced water depth. Reduced water depth is evaluated after applying corrections on the water depths observed during single line hydrographic survey with reference to Chart datum's. Navigable stretch available for least available depth (LAD) of <1.0 m, 1.0 m to 1.5 m, 1.5 m to 2.0 m and >2.0 m for the waterway is presented in **Table 27**.

Table 27: Waterway length with varying LAD w.r.t CD

Sl No.	Features	Results
1.	Waterway Length	314.0 Km
2.	Length with Topographic Survey	0.0 Km
3.	Length with Bathymetric Survey	314.0 Km
4.	Maximum available draft	15.97 m

Sl No.	Features	Results
5.	Minimum available draft	0.00 m
6.	Waterway length with <1.0 m draft	50.42 Km
7.	Waterway length with 1.0 – 1.5 m draft	42.12 Km
8.	Waterway length with 1.5 – 2.0 m draft	49.27 Km
9.	Waterway length with >2.0 m draft	172.19 Km

From the above table, it is inferred that the waterways have >2.0 m LAD w.r.t to CD for 54% of stretch. The river also gets a tidal advantage of >1m in estuarine section.

The river Subarnrekha flows between Chandil Dam and Bay of Bengal, hence by the means of lock gates and barrages water level can be maintained throughout the year for Navigation. The possibility of the same shall be checked and optimised on the basis of Stage – 2, DPR studies after detailed hydrographic and hydro-morphological survey of the waterway stretch.

9.3 Available Discharges

The available discharges at Jamshedpur and Ghatsila G&D location are provided in **Table 28** below.

Table 28: Max, Min and Average Discharges at G&D sites in last 10 years (2004 – 2013)

Year	Jamshedpur G&D Site (chainage 275 Km)				Ghatsila G&D site (chainage 227 Km)			
	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with $>Q_{avg}$	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with $>Q_{avg}$
2004	3201.44	4.12	144.92	80	4000.00	7.70	155.29	82
2005	1150.48	5.74	77.69	127	1602.19	5.11	98.85	87
2006	3319.68	6.80	263.73	84	4600.10	4.24	330.32	87
2007	3856.40	7.08	278.93	93	6060.56	14.50	381.31	93
2008	7382.00	4.50	290.68	112	9609.00	16.30	317.33	111
2009	3577.60	7.68	162.55	89	4191.58	21.40	239.40	106

Year	Jamshedpur G&D Site (chainage 275 Km)				Ghatsila G&D site (chainage 227 Km)			
	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with >Q_{avg}	Max. Q (m^3/sec)	Min. Q (m^3/sec)	Avg. Q (m^3/sec)	No. of days in year with >Q_{avg}
2010	240.00	7.20	31.72	97	410.91	0.40	58.19	93
2011	4548.17	6.00	291.12	73	5580.27	20.12	424.08	95
2012	2020.00	7.16	145.54	93	2300.00	33.34	227.52	98
2013	8769.78	11.13	294.20	71	4886.27	16.94	283.62	105

9.4 Cross - structures

During reconnaissance survey, details of cross-structures have been collected and their minimum horizontal and vertical clearance has been evaluated on the basis of visual assessment as shown in **Table 29** below. The detailed list of cross-structures is provided in **Table 7** and **Table 8**.

Table 29: Minimum Horizontal and Vertical Clearance along Waterways

Length (Km)	Dams/ Barrages/Locks	Bridges/ Crossing	Min Ver. /Hor. Clearance (m)	High-Tension Lines	Min Ver. Clearance (m)
314.0	1	21	7.0 / 5.0	13	5.0

Vertical clearance is with reference to the H.F.L.
Horizontal Clearance is the minimum distance between the bridge piers, on the basis of visual assessment.

9.5 SWOT Analysis

SWOT analysis is a technique commonly used to assist in identifying strategic direction for an organization or practice. It helps to make an assessment of internal environment and scrutiny of external environment, with an objective to take maximum benefits by having an appropriate proposition. It is preferred for the present work as it yields useful information about the future viability of the considered inland waterway system. The predictive capabilities in the technique come about from the consideration of system's strengths and weaknesses in the context of the development of Inland Waterway System, which may present opportunities and threats.

	INTERNAL		
POSITIVE	**STRENGTH**	**WEAKNESS**	NEGATIVE
	➢ Commitment of Govt. of India for Developing Inland Waterways Sector. ➢ Environmental friendly mode of Transport ➢ Increase in Infrastructure Facilities as alternative mode of transport. ➢ Comparatively high level of transport safety. ➢ Reliable services under predictable weather conditions. ➢ Low transport costs (per km) for bulk shipments. ➢ Long term effective cost control measures (O&M). ➢ Capable of bringing down decongestion from the Road Transport. ➢ Location of waterway with respect to Major Industrial City like Jamshedpur. ➢ Location of proposed port near the confluence of river with Bay of Bengal	➢ Huge Initial Investment ➢ High Maintenance Cost ➢ High tariff structure for Inland Transport. ➢ Limited knowledge of IWT among shippers. ➢ Dependence on inter-modality for door-to door services. ➢ Substantial cost differentials w.r.t other transports. ➢ Water level fluctuations having impacts on Ships Ballast /Loading conditions. ➢ Dredging capability of GoI is 16% of National requirement. ➢ Low discharge releases from Chandil Dam.	
	➢ Trigger new traffic in the hinterland ➢ Boost International and National trade of commodities. ➢ Improvement of the capacity/quality of the Infrastructure. ➢ Enhance inter-modality. ➢ Implementation of infrastructure links. ➢ Improved Supply-Demand logistic chains ➢ Creation of reliable employment for the people.	➢ Lack of Skilled Man-power. ➢ Environmental policy restrictions on transport infrastructure policies. ➢ Limited financial means. ➢ Fast growing economic sectors often road oriented: low IWT affinity. ➢ Priority of investments in road/ rail infrastructure as per the present scenario. ➢ Land Acquisition	
	OPPORTUNITY	**THREAT**	
	EXTERNAL		

Figure 10: SWOT Analysis

The strengths and weaknesses of a system are determined by the internal elements, whereas external forces dictate opportunities and threats. Strengths can be defined as any available resource that can

be used to improve its performance. Weaknesses are flaws/shortcomings of any system that may cause to lose a competitive advantage, efficiency or resources. Sometimes it is recommended to identify opportunities and threats first in order to more quickly ring to light the system's strengths and weaknesses. Many of the threats are based on weaknesses. Further, SWOT analysis helps in categorizing the key internal and external factors that are important to achieving the objective. With regards to assessing the feasibility of national waterway for navigation, this exercise will help us identify the important factors to be considered while designing the future action for DPR study in Stage 2 and strategic plan for its development.

9.6 Summary

The salient features of the feasibility study for 314 km stretch of Subarnrekha as national waterway are,

- The national waterway of 314 km of Subarnrekha river is feasible for navigation
- The horizontal and vertical clearance of existing cross-structures is in the range of 5m – 18m and 7m-12m respectively.
- On the basis of reduced water depth, LAD of > 2.0 m is available for 172.19 km length of the waterway, 1.5 m to 2.0 m is available for 49.27 km length, 1.5 to 2.0 m is available for 42.12 km and <1.0 of LAD is available for 50.42 km of the waterway stretch respectively with respect to chart datum;
- Taking in to account the tide and CWC discharges, the LAD of 2m is available for most of the sections of the River over the year (Refer **Table 26** and **Table 27**).
- Considering the length of the river and availability of numerous minor and major industries 5km reach across the bank , the river has huge economic potential for Development of Waterway
- The capacity of the waterway can be enhanced by constructing check dams and lockgates, however the same shall be verified and optimized only during Stage-II DPR studies, on the basis of detailed hydrographic and hydro-morphological survey of the waterway stretch.
- The waterway will be an alternated mode of connectivity to the proposed Port coming up at the confluence of Subarnrekha river with Bay of Bengal.
- Not only there is existing traffic but also the development of waterway will trigger new traffic.

9.7 Critical areas requiring detailed investigations

Critical areas along the waterways, requiring detailed investigations during Stage – II, are identified on the basis of draft availability, location of hindrances, areas requiring clearances etc. On the basis of above following critical areas are identified and provided in tables below:

Sr. No.	Location	Chainage (Km)	Easting	Northing
Areas with Protruded Bed Rock				
1	Narayanpur	171.55	471274.4	2457171
2	Sirsa	177.55	466387.9	2458969
3	Joti Pahari	189.65	464648.4	2467821
4	Shirbai	192.85	463174	2470610
5	Muthurkham	194.55	462159.6	2471646
6	Balijuri	196.05	460764.5	2472271
7	Ramasholi	215.35	452073.1	2485619
8	Chhabisha	223.05	447879.1	2489919
9	Jonbani	224.55	448668.2	2491091
10	Bagula	228.55	445670.5	2493626
11	Madnabera	261.05	429884.8	2514017
12	Luyabasa	265.85	429924.4	2518006
13	Nutandih	270.95	429884.8	2514017
14	Gautam Vihar	280.35	419923.3	2523187
Wooden Bridge				
1	Patna	58.55	518890	2409444
2	Baghabali	60.1	520536.7	2409752

Sr. No.	Location	Chainage (Km)	Easting	Northing
3	Sonakania	73.65	526259.2	2418516
4	Sonakania	73.75	526231.2	2418704
5	Malpada (moya)	75.85	525327.1	2420412
6	Bilaspur	85.15	524002.5	2428130
7	Basra Ghat	100.05	518724.5	2438550
8	Phulboni	108.15	513494	2442966
9	Bidhyadharpur	121.65	505701.6	2450387
Sand Bridge				
1	Totapara	78.45	524812.8	2422535
2	Manikui	303.75	404760.6	2532551

In addition to above, the waterway length of about 50.42 Km, having flow depth of less than 1 m also requires detail investigation during DPR stage studies.

9.8 Survey and Investigations required for stage – II studies

Following survey and investigations are required to be done during Stage – II studies:

i) Hydrographic and Hydro morphological Survey, as per TOR, comprising of:

a) Erection of bench mark pillars and water level gauges and observing reading.
b) Detailed bathymetric and topographic survey.
c) Current velocity and discharge measurement.
d) Collection of water and bottom samples and testing.
e) Collection of topographical features.

ii) Traffic Survey.
iii) Geo-tech investigation on proposed locations for Jetties and Terminal structures.
iv) Environmental impact assessment (EIA).

9.9 Way Forward: Waterway Development

The Combining knowledge on the physical constraints, actual and future uses of the river and the valley, economic potential and needs, or absence thereof, allows the characterization of the river for development as a waterway. The reconnaissance survey data collected with regard to physical constraints can be turned into cost to make a river navigable. The potential of possible navigation in the stretches of proposed inland waterway have been determined using raw water depths. Many stretches are generally navigable without any obstructions, except few shallow patches. Although several challenges do exist to make Subarnrekha as National waterway, but with respect to long-term economic interest of the nation the financial investment is advisable.

Economic Interest / **Financial Investment**	Local	Regional	National	International
Low				
Moderate			Subarnrekha Waterway	
High				
Very High				

Subarnrekha waterway is recommended for Stage – II DPR preparation in view of the following potential advantages:

- Connectivity of major industrial towns with Subarnrekha waterway gives it an additional economic advantage.
- Connectivity with a major port proposed at confluence of river with Bay of Bengal.
- Increasing cargo potential.
- Reduction in existing traffic load on rail and road infrastructure.

Annexure 1: Levelling results of Subarnrekha Waterway

Seventeen Temporary Bench Marks has been established, in between the course of survey at different places by using Trimble RTK SPS 855. Auto level SOKIA B-30 was used to establish the zero of the tide gauge with reference the TBMs. The observed readings in Auto Level are provided below:

LEVELLING BETWEEN TEMPORARY BENCH MARK 1 & TIDE POLE

BS	FS	HI	RL	REMARK
1.463		5.305	3.842	TBM 1
	4.702		0.603	TIDE POLE

BS	FS	HI	RL	REMARK
4.002		4.605	0.603	TIDE POLE
	0.763		3.842	TBM 1

LEVELLING BETWEEN TEMPORARY BENCH MARK 2 & TIDE POLE

BS	FS	HI	RL	REMARK
0.234		4.958	4.724	TBM 2
	4.609		0.349	TIDE POLE

BS	FS	HI	RL	REMARK
4.612		4.961	0.349	TIDE POLE
	0.237		4.724	TBM 2

LEVELLING BETWEEN TEMPORARY BENCH MARK 3 & TIDE POLE

BS	FS	HI	RL	REMARK
1.235		9.043	7.808	TBM 3
0.546	4.568	5.021	4.475	CP 1
	4.438		0.583	TIDE POLE

BS	FS	HI	RL	REMARK
4.521		5.104	0.583	TIDE POLE
4.361	0.631	8.834	4.473	CP 2
	1.026	7.808	7.808	TBM 3

LEVELLING BETWEEN TEMPORARY BENCH MARK 4 & TIDE POLE

BS	FS	HI	RL	REMARK
1.42		11.39	9.97	TBM 4
0.956	2.975	9.371	8.415	CP 1
	4.509		4.862	TIDE POLE

BS	FS	HI	RL	REMARK
4.521		9.383	4.862	TIDE POLE
3.01	1.104	11.289	8.279	CP 2
	1.319	9.97	9.97	TBM 4

LEVELLING BETWEEN TEMPORARY BENCH MARK 5 & TIDE POLE

BS	FS	HI	RL	REMARK
0.641			9.665	TBM 5
	4.107	10.306	6.199	TIDE POLE

BS	FS	HI	RL	REMARK
4.107			6.199	TIDE POLE
	0.642	10.306	9.664	TBM 5

LEVELLING BETWEEN TEMPORARY BENCH MARK 6 & TIDE POLE

BS	FS	HI	RL	REMARK
1.207			21.993	TBM 6
	3.541	23.2	19.659	TIDE POLE

BS	FS	HI	RL	REMARK
3.282			19.659	TIDE POLE
	0.948	22.941	21.993	TBM 6

LEVELLING BETWEEN TEMPORARY BENCH MARK 7 & TIDE POLE

BS	FS	HI	RL	REMARK
1.56		31.608	30.048	TBM 7
1.463	2.894	30.177	28.714	CP 1
1.221	3.751	27.647	26.426	CP2
	2.532		25.115	TIDE POLE

BS	FS	HI	RL	REMARK
2.489		27.604	25.115	TIDE POLE
3.892	1.334	30.162	26.27	CP 3
3.002	1.369	31.795	28.793	CP 4
	1.747		30.048	TBM 7

LEVELLING BETWEEN TEMPORARY BENCH MARK 8 & TIDE POLE

BS	FS	HI	RL	REMARK
1.489		40.834	39.345	TBM 8
1.356	2.014	40.176	38.82	CP 1
1.235	3.894	37.517	36.282	CP2
	2.699		34.818	TIDE POLE

BS	FS	HI	RL	REMARK
2.184		37.002	34.818	TIDE POLE
3.753	1.334	39.421	35.668	CP 3
2.986	1.369	41.038	38.052	CP 4
	1.693		39.345	TBM 8

LEVELLING BETWEEN TEMPORARY BENCH MARK 9 & TIDE POLE

BS	FS	HI	RL	REMARK
1.489		45.738	44.249	TBM 9
	2.362		43.376	TIDE POLE

BS	FS	HI	RL	REMARK
2.184		46.56	44.376	TIDE POLE
	2.311		44.249	TBM 9

LEVELLING BETWEEN TEMPORARY BENCH MARK 10 & TIDE POLE

BS	FS	HI	RL	REMARK
1.489		62.6	61.111	TBM 10
1.356	2.014	61.942	60.586	CP 1
1.235	3.894	59.283	58.048	CP 2
1.389	2.699	57.973	56.584	CP 3
1.567	2.989	56.551	54.984	CP 4

BS	FS	HI	RL	REMARK
2.184		52.383	50.199	TIDE POLE
3.753	1.334	54.802	51.049	CP 7
2.986	1.369	56.419	53.433	CP 8
3.776	1.693	58.502	54.726	CP 9
4.177	1.824	60.855	56.678	CP 10

BS	FS	HI	RL	REMARK
1.341	2.584	55.308	53.967	CP 5
1.321	3.103	53.526	52.205	CP 6
	3.327		50.199	TIDE POLE

BS	FS	HI	RL	REMARK
4.57	2.004	63.421	58.851	CP 11
	2.311		61.11	TBM 10

LEVELLING BETWEEN TEMPORARY BENCH MARK 11 & TIDE POLE

BS	FS	HI	RL	REMARK
1.489		62.395	60.906	TBM 11
1.356	2.014	61.737	60.381	CP 1
	3.02		58.717	TIDE POLE

BS	FS	HI	RL	REMARK
2.184		60.901	58.717	TIDE POLE
3.753	1.334	63.32	59.567	CP 2
	2.414		60.906	TBM 11

LEVELLING BETWEEN TEMPORARY BENCH MARK 12 & TIDE POLE

BS	FS	HI	RL	REMARK
1.489		73.094	71.605	TBM 12
1.356	2.014	72.436	71.08	CP 1
1.291	3.02	70.707	69.416	CP 2
	2.561		68.146	TIDE POLE

BS	FS	HI	RL	REMARK
2.184		70.33	68.146	TIDE POLE
3.753	1.334	72.749	68.996	CP 3
2.421	1.339	73.831	71.41	CP 4
	2.226		71.605	TBM 12

LEVELLING BETWEEN TEMPORARY BENCH MARK 13 & TIDE POLE

BS	FS	HI	RL	REMARK
1.463		94.515	93.052	TBM 13
1.342	3.889	91.968	90.626	CP 1
0.564	4.853	87.679	87.115	CP 2
	3.213		84.466	TIDE POLE

BS	FS	HI	RL	REMARK
3.192		87.658	84.466	TIDE POLE
4.741	0.631	91.768	87.027	CP 3
3.935	1.457	94.246	90.311	CP 4
	1.193		93.053	TBM 13

LEVELLING BETWEEN TEMPORARY BENCH MARK 14 & TIDE POLE

BS	FS	HI	RL	REMARK
1.463		99.333	97.87	TBM 14
	3.959		95.374	TIDE POLE

BS	FS	HI	RL	REMARK
4.002		99.376	95.374	TIDE POLE
	1.506		97.87	TBM 14

LEVELLING BETWEEN TEMPORARY BENCH MARK 15 & TIDE POLE

BS	FS	HI	RL	REMARK
1.235		127.815	126.58	TBM 15
1.698	4.568	124.945	123.247	CP 1
1.089	4.892	121.142	120.053	CP 2
	4.816		116.326	TIDE POLE

BS	FS	HI	RL	REMARK
4.942		121.268	116.326	TIDE POLE
4.736	0.631	125.373	120.637	CP 3
4.689	1.457	128.605	123.916	CP 4
	2.024		126.581	TBM 15

LEVELLING BETWEEN TEMPORARY BENCH MARK 16 & TIDE POLE

BS	FS	HI	RL	REMARK
0.532		141.285	140.753	TBM 16
1.356	4.568	138.073	136.717	CP 1
2.341	4.892	135.522	133.181	CP 2
2.748	4.816	133.454	130.706	CP 3
	3.896		129.558	TIDE POLE

BS	FS	HI	RL	REMARK
3.756		133.314	129.558	TIDE POLE
4.943	2.289	135.968	131.025	CP 4
4.797	2.156	138.609	133.812	CP 5
4.832	2.012	141.429	136.597	CP 6
	0.678		140.751	TBM 16

LEVELLING BETWEEN TEMPORARY BENCH MARK 17 & TIDE POLE

BS	FS	HI	RL	REMARK
0.532		155.306	154.774	TBM 17
	4.923		150.383	TIDE POLE

BS	FS	HI	RL	REMARK
4.918		155.301	150.383	TIDE POLE
	0.527		154.774	TBM 17

Annexure 2: Observed Water levels at the Tide Poles

Chandrabali TBM - 1 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
14:00:00	16-Dec-15	1.423
14:15:00	16-Dec-15	1.338
14:30:00	16-Dec-15	1.238
14:45:00	16-Dec-15	1.188
15:00:00	16-Dec-15	1.162
15:15:00	16-Dec-15	1.134
15:30:00	16-Dec-15	1.103
15:45:00	16-Dec-15	1.07
16:00:00	16-Dec-15	1.029
16:15:00	16-Dec-15	1.021
16:30:00	16-Dec-15	0.998
16:45:00	16-Dec-15	0.977
17:00:00	16-Dec-15	0.911
17:15:00	16-Dec-15	0.883
17:30:00	16-Dec-15	0.878

Manunagar TBM - 2 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
11:45:00	17-Dec-15	0.855
12:00:00	17-Dec-15	0.939
12:15:00	17-Dec-15	1.039
12:30:00	17-Dec-15	1.139
12:45:00	17-Dec-15	1.284
13:00:00	17-Dec-15	1.409
13:15:00	17-Dec-15	1.549
13:30:00	17-Dec-15	1.679
13:45:00	17-Dec-15	1.789
14:00:00	17-Dec-15	1.879
14:15:00	17-Dec-15	1.964
14:30:00	17-Dec-15	2.019
14:45:00	17-Dec-15	2.039
15:00:00	17-Dec-15	2.004
15:15:00	17-Dec-15	1.939
15:30:00	17-Dec-15	1.869

Chakamadhab TBM - 3 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
14:30:00	17-Dec-15	0.647
14:45:00	17-Dec-15	0.647
15:00:00	17-Dec-15	0.675
15:15:00	17-Dec-15	0.687
15:30:00	17-Dec-15	0.715
15:45:00	17-Dec-15	0.734
16:00:00	17-Dec-15	0.777
16:15:00	17-Dec-15	0.787

Chakamadhab TBM - 3 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	19-Dec-15	0.738
9:15:00	19-Dec-15	0.733
9:30:00	19-Dec-15	0.728
9:45:00	19-Dec-15	0.723
10:00:00	19-Dec-15	0.718
10:15:00	19-Dec-15	0.713
10:30:00	19-Dec-15	0.708
10:45:00	19-Dec-15	0.706
11:00:00	19-Dec-15	0.703
11:15:00	19-Dec-15	0.701
11:30:00	19-Dec-15	0.698
11:45:00	19-Dec-15	0.693
12:00:00	19-Dec-15	0.691
12:15:00	19-Dec-15	0.688
12:30:00	19-Dec-15	0.688
12:45:00	19-Dec-15	0.688
13:00:00	19-Dec-15	0.688
13:15:00	19-Dec-15	0.688
13:30:00	19-Dec-15	0.688
13:45:00	19-Dec-15	0.688
14:00:00	19-Dec-15	0.688
14:15:00	19-Dec-15	0.690
14:30:00	19-Dec-15	0.693
14:45:00	19-Dec-15	0.698
15:00:00	19-Dec-15	0.703
15:15:00	19-Dec-15	0.708
15:30:00	19-Dec-15	0.713
15:45:00	19-Dec-15	0.718

Rajghat TBM - 4 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	20-Dec-15	5.352
12:00:00	20-Dec-15	5.352
15:30:00	20-Dec-15	5.352

Makarapur TBM 5 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	19-Dec-15	8.049
12:00:00	19-Dec-15	8.049
15:45:00	21-Dec-15	8.049

Bhansra TBM 6 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	21-Dec-15	19.769
12:00:00	21-Dec-15	19.769
16:00:00	21-Dec-15	19.769

Chuapal TBM 7 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	22-Dec-15	25.505
12:00:00	22-Dec-15	25.505
16:15:00	22-Dec-15	25.505

Nayabasan 8 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	24-Dec-15	35.218
12:00:00	24-Dec-15	35.218
15:30:00	24-Dec-15	35.218

Jamsola TBM 9 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	25-Dec-15	43.936
12:00:00	25-Dec-15	43.936
15:30:00	25-Dec-15	43.936

Maheshpur TBM 10 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	26-Dec-15	50.388
12:00:00	26-Dec-15	50.388
15:30:00	26-Dec-15	50.388

Burujbani TBM 11 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	28-Dec-15	59.047
12:00:00	28-Dec-15	59.047
15:15:00	28-Dec-15	59.047

Jonbani TBM 12 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	29-Dec-15	68.443
12:00:00	29-Dec-15	68.443
15:30:00	29-Dec-15	68.443

Digri TBM 13 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	30-Dec-15	84.786
12:00:00	30-Dec-15	84.786
15:15:00	30-Dec-15	84.786

Belajuri TBM 14 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	01-Jan-16	96.271
12:00:00	01-Jan-16	96.271
15:15:00	01-Jan-16	96.271

Jamshedpur TBM 15 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	2-Jan-16	116.426
12:00:00	2-Jan-16	116.426
15:15:00	2-Jan-16	116.426

Manikui TBM 16 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	3-Jan-16	129.810
12:00:00	3-Jan-16	129.810
15:15:00	3-Jan-16	129.810

Ghoraling TBM 17 Time (IST) in hh:mm & Hts are in Mtrs. Water Level are with respect to MSL.		
TIME	DATE	WATER LEVEL
9:00:00	3-Jan-16	150.597
12:00:00	3-Jan-16	150.597

Annexure 3: Water Depth along Subarnrekha Waterway

(0.0 Km Chainage starts from confluence of Subarnrekha River with Bay of Bengal)

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
0.03	1.45	-1.816	1.784	3.60	0.00
0.07	2.96	-1.807	1.744	3.55	0.00
0.09	1.27	-1.802	1.764	3.57	0.00
0.18	3.08	-1.782	1.744	3.53	0.00
0.31	2.74	-1.752	1.734	3.49	0.00
0.44	2.44	-1.721	1.724	3.45	0.00
0.57	1.64	-1.691	1.719	3.41	0.00
0.69	1.47	-1.662	1.714	3.38	0.00
0.81	1.45	-1.632	1.709	3.34	0.00
0.94	1.48	-1.602	1.704	3.31	0.00
1.06	1.67	-1.575	1.702	3.28	0.00
1.18	2.51	-1.546	1.699	3.24	0.00
1.30	4.10	-1.517	1.696	3.21	0.89
1.42	4.76	-1.489	1.694	3.18	1.58
1.53	4.53	-1.462	1.692	3.15	1.38
1.65	4.45	-1.434	1.689	3.12	1.33
1.77	4.41	-1.407	1.686	3.09	1.32
1.88	4.45	-1.380	1.684	3.06	1.39
1.99	4.28	-1.354	1.682	3.04	1.24
2.11	4.34	-1.327	1.679	3.01	1.33
2.23	4.20	-1.299	1.677	2.98	1.22
2.34	3.97	-1.272	1.674	2.95	1.02
2.46	3.35	-1.243	1.668	2.91	0.44
2.58	3.09	-1.215	1.662	2.88	0.21
2.69	4.21	-1.191	1.657	2.85	1.36
2.74	4.01	-1.177	1.654	2.83	1.18
2.84	5.05	-1.154	1.652	2.81	2.24
2.94	5.47	-1.131	1.650	2.78	2.69
3.03	5.75	-1.110	1.648	2.76	2.99

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
3.11	5.68	-1.091	1.646	2.74	2.94
3.20	5.54	-1.070	1.644	2.71	2.83
3.27	4.34	-1.052	1.642	2.69	1.65
3.36	4.03	-1.032	1.640	2.67	1.36
3.53	4.61	-0.991	1.636	2.63	1.98
3.63	4.36	-0.968	1.634	2.60	1.76
3.73	4.26	-0.945	1.632	2.58	1.68
3.83	3.99	-0.922	1.630	2.55	1.44
3.93	3.48	-0.898	1.628	2.53	0.95
4.02	3.47	-0.875	1.626	2.50	0.97
4.11	4.97	-0.855	1.624	2.48	2.49
4.19	6.21	-0.835	1.622	2.46	3.75
4.28	6.28	-0.815	1.620	2.44	3.84
4.37	7.63	-0.794	1.618	2.41	5.22
4.52	4.27	-0.757	1.614	2.37	1.90
4.61	4.03	-0.737	1.612	2.35	1.68
4.69	4.30	-0.718	1.610	2.33	1.97
4.78	3.62	-0.697	1.608	2.31	1.31
4.88	3.52	-0.674	1.606	2.28	1.24
4.97	3.42	-0.653	1.604	2.26	1.16
5.06	3.54	-0.632	1.602	2.23	1.31
5.12	4.76	-0.616	1.600	2.22	2.54
5.18	5.40	-0.602	1.598	2.20	3.20
5.26	5.42	-0.584	1.596	2.18	3.24
5.34	5.35	-0.566	1.594	2.16	3.19
5.46	4.90	-0.537	1.591	2.13	2.77
5.62	5.26	-0.499	1.588	2.09	3.17
5.71	4.66	-0.478	1.586	2.06	2.60
5.81	3.96	-0.454	1.584	2.04	1.92

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
5.91	3.33	-0.430	1.582	2.01	1.32
6.01	3.14	-0.407	1.580	1.99	1.15
6.11	3.08	-0.383	1.579	1.96	1.12
6.26	2.65	-0.348	1.576	1.92	0.73
6.36	2.53	-0.325	1.574	1.90	0.63
6.45	2.43	-0.302	1.572	1.87	0.56
6.56	2.20	-0.277	1.570	1.85	0.35
6.67	2.91	-0.251	1.568	1.82	1.09
6.78	3.24	-0.224	1.566	1.79	1.45
6.90	3.27	-0.198	1.564	1.76	1.51
6.98	3.26	-0.180	1.562	1.74	1.52
7.08	4.03	-0.154	1.559	1.71	2.32
7.19	4.22	-0.129	1.556	1.69	2.53
7.28	4.44	-0.107	1.554	1.66	2.78
7.38	4.56	-0.084	1.552	1.64	2.92
7.48	3.73	-0.061	1.549	1.61	2.12
7.59	2.89	-0.035	1.547	1.58	1.31
7.70	2.21	-0.009	1.544	1.55	0.66
7.80	2.28	0.014	1.541	1.53	0.75
7.92	1.32	0.043	1.538	1.49	0.00
7.98	4.46	0.056	1.536	1.48	2.98
8.07	5.29	0.078	1.534	1.46	3.83
8.16	5.73	0.100	1.532	1.43	4.30
8.26	5.22	0.122	1.530	1.41	3.81
8.35	4.60	0.145	1.528	1.38	3.22
8.52	3.48	0.185	1.524	1.34	2.14
8.63	4.21	0.210	1.519	1.31	2.90
8.72	5.67	0.233	1.514	1.28	4.39
8.82	6.07	0.256	1.513	1.26	4.81

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
8.90	6.90	0.274	1.511	1.24	5.66
9.00	6.43	0.298	1.510	1.21	5.22
9.10	6.07	0.322	1.508	1.19	4.88
9.19	3.07	0.343	1.507	1.16	1.91
9.29	2.72	0.366	1.506	1.14	1.58
9.39	2.11	0.390	1.504	1.11	1.00
9.50	3.77	0.415	0.869	0.45	3.32
9.59	5.89	0.438	0.263	-0.17	6.06
9.69	5.09	0.460	-0.314	-0.77	5.86
9.79	4.57	0.484	-0.931	-1.41	5.98
9.90	4.37	0.509	-1.579	-2.09	6.46
9.98	4.93	0.529	-2.096	-2.62	7.55
10.17	2.71	0.575	-1.899	-2.47	5.18
10.35	3.40	0.617	-1.715	-2.33	5.73
10.54	3.11	0.660	-1.529	-2.19	5.30
10.68	3.17	0.693	-1.383	-2.08	5.25
10.86	2.37	0.735	-1.202	-1.94	4.31
11.04	1.61	0.778	-1.016	-1.79	3.40
11.19	0.96	0.815	-0.856	-1.67	2.63
11.37	2.72	0.856	-0.678	-1.53	4.25
11.55	3.38	0.899	-0.493	-1.39	4.77
11.75	2.99	0.945	-0.292	-1.24	4.23
11.94	3.48	0.990	-0.097	-1.09	4.57
12.11	2.45	1.031	0.079	-0.95	3.40
12.30	2.69	1.075	0.270	-0.80	3.49
12.49	3.48	1.120	0.465	-0.65	4.13
12.67	3.39	1.163	0.653	-0.51	3.90
12.85	3.33	1.181	0.652	-0.53	3.86
13.02	3.33	1.198	0.651	-0.55	3.88

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
13.20	1.94	1.216	0.649	-0.57	2.51
13.37	2.45	1.234	0.648	-0.59	3.04
13.56	2.73	1.253	0.647	-0.61	3.34
13.77	3.14	1.274	0.646	-0.63	3.77
13.96	2.77	1.293	0.644	-0.65	3.42
14.13	1.21	1.309	0.643	-0.67	1.88
14.30	3.69	1.326	0.642	-0.68	4.37
14.49	2.47	1.346	0.641	-0.70	3.17
14.68	3.10	1.365	0.639	-0.73	3.83
14.86	3.02	1.383	0.638	-0.75	3.77
15.04	4.22	1.401	0.637	-0.76	4.98
15.21	4.44	1.418	0.636	-0.78	5.22
15.38	4.86	1.435	0.635	-0.80	5.66
15.57	2.54	1.454	0.633	-0.82	3.36
15.75	2.22	1.472	0.632	-0.84	3.06
15.94	2.27	1.492	0.631	-0.86	3.13
16.12	1.73	1.510	0.630	-0.88	2.61
16.30	2.54	1.528	0.629	-0.90	3.44
16.48	3.17	1.546	0.627	-0.92	4.09
16.67	3.26	1.565	0.626	-0.94	4.20
16.86	3.87	1.584	0.625	-0.96	4.83
17.06	2.84	1.604	0.623	-0.98	3.82
17.25	4.23	1.623	0.622	-1.00	5.23
17.43	8.84	1.641	0.621	-1.02	9.86
17.62	6.61	1.660	0.620	-1.04	7.65
17.81	6.13	1.680	0.618	-1.06	7.19
18.01	3.76	1.699	0.617	-1.08	4.84
18.21	4.46	1.719	0.616	-1.10	5.56
18.40	3.20	1.738	0.614	-1.12	4.32

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
18.58	4.02	1.757	0.613	-1.14	5.16
18.78	5.27	1.777	0.612	-1.16	6.43
18.98	4.88	1.797	0.610	-1.19	6.07
19.18	4.86	1.817	0.609	-1.21	6.07
19.36	5.18	1.835	0.608	-1.23	6.41
19.55	3.39	1.854	0.607	-1.25	4.64
19.71	1.49	1.871	0.606	-1.27	2.76
19.87	1.50	1.887	0.604	-1.28	2.78
20.04	1.42	1.903	0.603	-1.30	2.72
20.21	1.39	1.920	0.602	-1.32	2.71
20.39	2.44	1.938	0.601	-1.34	3.78
20.56	4.15	1.956	0.600	-1.36	5.51
20.73	5.69	1.973	0.599	-1.37	7.06
20.90	9.36	1.990	0.598	-1.39	10.75
21.08	6.83	2.007	0.596	-1.41	8.24
21.26	5.02	2.026	0.595	-1.43	6.45
21.42	3.09	2.042	0.594	-1.45	4.54
21.61	3.84	2.061	0.593	-1.47	5.31
21.76	3.99	2.076	0.592	-1.48	5.47
21.90	3.19	2.090	0.591	-1.50	4.69
22.01	2.74	2.102	0.590	-1.51	4.25
22.08	1.33	2.109	0.590	-1.52	2.85
22.24	0.67	2.124	0.589	-1.54	2.21
22.34	1.33	2.134	0.588	-1.55	2.88
22.43	1.84	2.143	0.587	-1.56	3.40
22.55	0.57	2.155	0.586	-1.57	2.14
22.68	1.35	2.168	0.586	-1.58	2.93
22.84	1.19	2.185	0.584	-1.60	2.79
23.02	0.84	2.202	0.583	-1.62	2.46

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
23.18	1.75	2.219	0.582	-1.64	3.39
23.34	2.87	2.235	0.581	-1.65	4.52
23.54	4.19	2.255	0.580	-1.68	5.87
23.65	5.94	2.266	0.579	-1.69	7.63
23.78	2.14	2.279	0.578	-1.70	3.84
23.94	3.29	2.295	0.577	-1.72	5.01
24.10	6.25	2.311	0.576	-1.74	7.99
24.21	5.34	2.322	0.575	-1.75	7.09
24.38	4.63	2.339	0.574	-1.76	6.39
24.56	4.32	2.358	0.573	-1.78	6.10
24.73	5.59	2.374	0.572	-1.80	7.39
24.90	4.82	2.392	0.571	-1.82	6.64
25.08	2.62	2.409	0.569	-1.84	4.46
25.26	3.84	2.428	0.568	-1.86	5.70
25.43	3.55	2.445	0.567	-1.88	5.43
25.61	6.76	2.462	0.566	-1.90	8.66
25.79	11.51	2.481	0.565	-1.92	13.43
25.97	9.66	2.499	0.563	-1.94	11.60
26.14	10.19	2.516	0.562	-1.95	12.14
26.31	4.68	2.533	0.561	-1.97	6.65
26.48	2.57	2.550	0.560	-1.99	4.56
26.64	2.22	2.566	0.559	-2.01	4.23
26.78	4.30	2.581	0.558	-2.02	6.32
26.95	4.20	2.598	0.557	-2.04	6.24
27.12	4.16	2.614	0.556	-2.06	6.22
27.29	4.76	2.631	0.555	-2.08	6.84
27.48	7.80	2.650	0.553	-2.10	9.90
27.65	7.23	2.668	0.552	-2.12	9.35
27.82	3.93	2.685	0.551	-2.13	6.06

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
27.98	1.90	2.701	0.550	-2.15	4.05
28.15	3.02	2.718	0.549	-2.17	5.19
28.34	1.75	2.737	0.547	-2.19	3.94
28.50	1.46	2.753	0.546	-2.21	3.67
28.66	1.41	2.769	0.545	-2.22	3.63
28.81	0.87	2.784	0.544	-2.24	3.11
28.97	1.54	2.800	0.543	-2.26	3.80
29.12	0.82	2.815	0.542	-2.27	3.09
29.27	0.92	2.831	0.541	-2.29	3.21
29.42	1.14	2.846	0.540	-2.31	3.45
29.57	0.83	2.860	0.539	-2.32	3.15
29.71	0.80	2.875	0.538	-2.34	3.14
29.82	0.80	2.886	0.537	-2.35	3.15
29.93	1.14	2.896	0.537	-2.36	3.50
30.05	0.80	2.909	0.536	-2.37	3.17
30.16	1.14	2.920	0.535	-2.39	3.53
30.28	0.86	2.932	0.534	-2.40	3.26
30.41	0.96	2.945	0.534	-2.41	3.37
30.49	2.06	2.953	0.533	-2.42	4.48
30.60	2.31	2.964	1.388	-1.58	3.89
30.72	3.09	2.976	2.346	-0.63	3.72
30.86	4.28	2.994	2.362	-0.63	4.91
31.02	5.35	3.015	2.380	-0.64	5.99
31.18	6.10	3.036	2.398	-0.64	6.74
31.32	3.31	3.054	2.414	-0.64	3.95
31.41	0.66	3.066	2.424	-0.64	1.30
31.48	0.99	3.075	2.432	-0.64	1.63
31.52	0.29	3.080	2.436	-0.64	0.93
31.54	1.62	3.083	2.439	-0.64	2.26

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
31.57	2.34	3.087	2.442	-0.64	2.98
31.62	1.87	3.094	2.448	-0.65	2.52
31.72	1.06	3.106	2.459	-0.65	1.71
31.77	0.34	3.113	2.464	-0.65	0.99
31.86	0.36	3.125	2.475	-0.65	1.01
31.97	0.68	3.139	2.487	-0.65	1.33
32.06	0.89	3.150	2.497	-0.65	1.54
32.15	1.37	3.163	2.508	-0.66	2.03
32.26	0.66	3.178	2.521	-0.66	1.32
32.36	0.69	3.190	2.531	-0.66	1.35
32.45	0.50	3.202	2.542	-0.66	1.16
32.65	0.89	3.228	2.564	-0.66	1.55
32.74	1.72	3.240	2.574	-0.67	2.39
32.87	3.17	3.256	2.588	-0.67	3.84
33.01	3.04	3.275	2.605	-0.67	3.71
33.16	2.28	3.294	2.621	-0.67	2.95
33.29	1.62	3.311	2.636	-0.67	2.29
33.42	2.26	3.328	2.651	-0.68	2.94
33.56	2.23	3.347	2.667	-0.68	2.91
33.70	3.30	3.365	2.683	-0.68	3.98
33.83	1.64	3.382	2.698	-0.68	2.32
33.96	4.28	3.399	2.712	-0.69	4.97
34.08	1.57	3.415	2.726	-0.69	2.26
34.20	2.26	3.430	2.740	-0.69	2.95
34.35	4.93	3.449	2.756	-0.69	5.62
34.49	4.04	3.469	2.773	-0.70	4.74
34.64	3.20	3.488	2.789	-0.70	3.90
34.78	2.48	3.505	2.804	-0.70	3.18
34.92	2.57	3.524	2.821	-0.70	3.27

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
35.07	6.63	3.544	2.838	-0.71	7.34
35.15	0.34	3.554	2.847	-0.71	1.05
35.34	0.39	3.580	2.869	-0.71	1.10
35.41	0.16	3.588	2.876	-0.71	0.87
35.47	1.76	3.596	2.883	-0.71	2.47
35.59	1.98	3.611	2.896	-0.72	2.70
35.73	4.53	3.630	2.912	-0.72	5.25
35.85	2.08	3.646	2.926	-0.72	2.80
35.98	2.66	3.663	2.941	-0.72	3.38
36.11	5.90	3.680	2.956	-0.72	6.62
36.24	2.94	3.696	2.970	-0.73	3.67
36.36	4.26	3.712	2.983	-0.73	4.99
36.58	1.97	3.740	3.008	-0.73	2.70
36.74	0.76	3.761	3.026	-0.74	1.50
36.84	0.75	3.774	3.037	-0.74	1.49
36.95	0.67	3.788	3.049	-0.74	1.41
37.06	2.08	3.804	3.063	-0.74	2.82
37.18	2.42	3.820	3.076	-0.74	3.16
37.31	4.82	3.835	3.090	-0.75	5.57
37.44	6.08	3.852	3.105	-0.75	6.83
37.57	7.94	3.870	3.120	-0.75	8.69
37.72	7.99	3.889	3.137	-0.75	8.74
37.87	4.02	3.909	3.154	-0.76	4.78
38.01	3.94	3.927	3.170	-0.76	4.70
38.16	4.90	3.947	3.186	-0.76	5.66
38.30	2.62	3.965	3.203	-0.76	3.38
38.44	2.38	3.984	3.219	-0.77	3.15
38.56	1.38	4.000	3.232	-0.77	2.15
38.62	1.30	4.007	3.238	-0.77	2.07

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
38.72	1.70	4.019	3.250	-0.77	2.47
38.77	1.64	4.027	3.256	-0.77	2.41
38.86	1.05	4.038	3.288	-0.75	1.80
39.03	0.63	4.060	3.348	-0.71	1.34
39.13	1.15	4.073	3.384	-0.69	1.84
39.24	1.59	4.087	3.422	-0.67	2.26
39.38	2.08	4.106	3.472	-0.63	2.71
39.52	3.11	4.124	3.524	-0.60	3.71
39.66	4.07	4.143	3.574	-0.57	4.64
39.80	5.62	4.161	3.625	-0.54	6.16
39.93	0.96	4.178	3.670	-0.51	1.47
40.04	4.27	4.193	3.711	-0.48	4.75
40.16	4.27	4.208	3.754	-0.45	4.72
40.30	2.70	4.226	3.804	-0.42	3.12
40.44	4.51	4.244	3.852	-0.39	4.90
40.56	0.90	4.261	3.898	-0.36	1.26
40.67	0.62	4.275	3.936	-0.34	0.96
40.78	2.81	4.289	3.975	-0.31	3.12
40.90	2.44	4.304	4.018	-0.29	2.73
41.02	2.44	4.321	4.062	-0.26	2.70
41.08	0.00	4.328	4.084	-0.24	0.24
41.17	1.01	4.339	4.114	-0.23	1.24
41.26	0.82	4.351	4.146	-0.21	1.03
41.39	0.81	4.369	4.194	-0.17	0.98
41.49	0.41	4.381	4.228	-0.15	0.56
41.55	0.39	4.390	4.252	-0.14	0.53
41.65	0.51	4.403	4.288	-0.11	0.62
41.75	0.38	4.416	4.324	-0.09	0.47
41.87	0.64	4.430	4.364	-0.07	0.71

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
41.97	0.27	4.444	4.401	-0.04	0.31
42.05	0.00	4.455	4.432	-0.02	0.02
42.15	0.52	4.468	4.466	0.00	0.52
42.29	0.46	4.486	4.516	0.03	0.43
42.37	0.47	4.496	4.544	0.05	0.42
42.45	0.55	4.507	4.574	0.07	0.48
42.55	0.75	4.520	4.609	0.09	0.66
42.65	0.88	4.533	4.645	0.11	0.77
42.82	0.75	4.555	4.706	0.15	0.60
42.88	0.29	4.563	4.727	0.16	0.13
42.95	0.00	4.572	4.754	0.18	0.00
43.05	0.25	4.585	4.789	0.20	0.05
43.17	0.00	4.601	4.832	0.23	0.00
43.25	0.00	4.612	4.861	0.25	0.00
43.43	0.47	4.634	4.923	0.29	0.18
43.52	0.92	4.646	4.955	0.31	0.61
43.62	0.60	4.659	4.993	0.33	0.27
43.73	2.39	4.673	5.031	0.36	2.03
43.83	0.41	4.687	5.067	0.38	0.03
43.91	1.18	4.697	5.097	0.40	0.78
44.00	1.00	4.709	5.128	0.42	0.58
44.05	0.85	4.716	5.147	0.43	0.42
44.15	0.00	4.728	5.182	0.45	0.00
44.18	0.00	4.732	5.192	0.46	0.00
44.31	0.45	4.735	5.181	0.45	0.00
44.40	0.25	4.737	5.174	0.44	0.00
44.45	0.43	4.738	5.169	0.43	0.00
44.58	0.44	4.741	5.159	0.42	0.02
44.65	0.29	4.743	5.153	0.41	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
44.78	0.46	4.746	5.143	0.40	0.06
44.85	0.38	4.747	5.137	0.39	0.00
44.99	1.07	4.750	5.126	0.38	0.69
45.09	0.99	4.753	5.118	0.37	0.62
45.15	0.32	4.754	5.113	0.36	0.00
45.34	0.28	4.758	5.098	0.34	0.00
45.44	0.51	4.761	5.089	0.33	0.18
45.52	0.46	4.763	5.083	0.32	0.14
45.55	0.25	4.763	5.080	0.32	0.00
45.67	0.00	4.766	5.071	0.30	0.00
45.77	0.00	4.768	5.063	0.29	0.00
45.85	0.00	4.770	5.056	0.29	0.00
45.94	0.00	4.772	5.048	0.28	0.00
45.95	0.25	4.772	5.048	0.28	0.00
46.09	0.35	4.776	5.037	0.26	0.09
46.16	0.41	4.777	5.031	0.25	0.16
46.30	0.52	4.780	5.019	0.24	0.28
46.37	0.41	4.782	5.013	0.23	0.18
46.46	0.63	4.784	5.007	0.22	0.41
46.56	1.40	4.786	4.998	0.21	1.19
46.70	1.38	4.789	4.987	0.20	1.18
46.82	2.26	4.792	4.977	0.18	2.08
46.86	1.36	4.793	4.974	0.18	1.18
46.95	0.00	4.795	4.966	0.17	0.00
47.08	0.00	4.798	4.956	0.16	0.00
47.18	0.77	4.800	4.948	0.15	0.62
47.29	1.19	4.803	4.939	0.14	1.05
47.42	1.41	4.806	4.928	0.12	1.29
47.50	0.07	4.808	4.922	0.11	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
47.56	0.00	4.809	4.917	0.11	0.00
47.59	1.74	4.810	4.914	0.10	1.64
47.65	0.38	4.811	4.909	0.10	0.28
47.75	0.00	4.813	4.901	0.09	0.00
47.86	0.25	4.816	4.893	0.08	0.17
47.97	0.25	4.818	4.884	0.07	0.18
48.06	0.27	4.820	4.876	0.06	0.21
48.15	0.28	4.823	4.869	0.05	0.23
48.25	0.30	4.825	4.861	0.04	0.26
48.38	0.00	4.828	4.850	0.02	0.00
48.45	0.27	4.829	4.844	0.01	0.26
48.58	0.29	4.832	4.834	0.00	0.29
48.68	0.34	4.835	4.826	-0.01	0.35
48.76	0.30	4.836	4.820	-0.02	0.32
48.88	0.27	4.839	4.810	-0.03	0.30
48.96	0.36	4.841	4.804	-0.04	0.40
49.07	0.31	4.844	4.794	-0.05	0.36
49.18	0.27	4.846	4.785	-0.06	0.33
49.26	0.38	4.848	4.779	-0.07	0.45
49.37	0.36	4.850	4.769	-0.08	0.44
49.45	0.35	4.852	4.763	-0.09	0.44
49.57	0.37	4.855	4.754	-0.10	0.47
49.69	0.39	4.858	4.744	-0.11	0.50
49.76	0.37	4.859	4.738	-0.12	0.49
49.88	0.42	4.862	4.728	-0.13	0.55
49.97	0.47	4.864	4.721	-0.14	0.61
50.06	0.44	4.866	4.713	-0.15	0.59
50.15	0.59	4.868	4.706	-0.16	0.75
50.26	0.62	4.871	4.697	-0.17	0.79

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
50.43	0.86	4.874	4.684	-0.19	1.05
50.51	1.03	4.876	4.677	-0.20	1.23
50.60	1.32	4.878	4.670	-0.21	1.53
50.68	1.35	4.880	4.663	-0.22	1.57
50.77	1.64	4.882	4.656	-0.23	1.87
50.86	1.82	4.884	4.649	-0.24	2.06
51.05	2.01	4.889	4.633	-0.26	2.27
51.14	1.98	4.891	4.626	-0.26	2.24
51.20	2.08	4.892	4.621	-0.27	2.35
51.29	2.02	4.894	4.614	-0.28	2.30
51.38	2.27	4.953	4.621	-0.33	2.60
51.47	2.33	5.017	4.629	-0.39	2.72
51.57	2.17	5.081	4.637	-0.44	2.61
51.67	3.47	5.149	4.645	-0.50	3.97
51.79	4.83	5.227	4.655	-0.57	5.40
51.85	5.45	5.272	4.660	-0.61	6.06
51.96	3.17	5.343	4.669	-0.67	3.84
52.07	3.16	5.414	4.677	-0.74	3.90
52.19	2.59	5.493	4.687	-0.81	3.40
52.26	2.51	5.541	4.693	-0.85	3.36
52.36	2.20	5.610	4.701	-0.91	3.11
52.48	0.99	5.686	4.710	-0.98	1.97
52.60	0.79	5.767	4.720	-1.05	1.84
52.66	0.00	5.804	4.725	-1.08	1.08
52.77	0.36	5.879	4.734	-1.15	1.51
52.88	0.55	5.956	4.743	-1.21	1.76
52.95	0.00	6.000	4.749	-1.25	1.25
53.05	0.00	6.069	4.757	-1.31	1.31
53.18	0.38	6.154	4.767	-1.39	1.77

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
53.27	0.26	6.213	4.775	-1.44	1.70
53.36	0.46	6.272	4.782	-1.49	1.95
53.47	0.77	6.347	4.791	-1.56	2.33
53.58	0.72	6.420	4.800	-1.62	2.34
53.68	1.17	6.482	4.807	-1.67	2.84
53.78	0.63	6.552	4.816	-1.74	2.37
53.87	0.47	6.612	4.823	-1.79	2.26
53.96	0.71	6.669	4.830	-1.84	2.55
54.08	0.57	6.751	4.840	-1.91	2.48
54.17	0.77	6.813	4.848	-1.97	2.74
54.29	0.62	6.891	4.857	-2.03	2.65
54.37	0.54	6.943	4.863	-2.08	2.62
54.46	0.40	7.004	4.871	-2.13	2.53
54.56	0.24	7.071	4.879	-2.19	2.43
54.65	0.44	7.130	4.886	-2.24	2.68
54.78	0.00	7.218	4.897	-2.32	2.32
54.86	0.08	7.267	4.903	-2.36	2.44
54.98	0.16	7.347	4.913	-2.43	2.59
55.08	0.28	7.414	4.921	-2.49	2.77
55.17	0.91	7.475	4.928	-2.55	3.46
55.25	0.54	7.529	4.935	-2.59	3.13
55.36	0.52	7.601	4.943	-2.66	3.18
55.45	1.00	7.663	4.951	-2.71	3.71
55.59	1.02	7.753	4.962	-2.79	3.81
55.67	0.00	7.808	4.969	-2.84	2.84
55.78	0.27	7.879	4.977	-2.90	3.17
55.86	0.45	7.935	4.984	-2.95	3.40
55.98	0.32	8.014	4.994	-3.02	3.34
56.08	0.51	8.081	5.002	-3.08	3.59

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
56.15	0.57	8.127	5.007	-3.12	3.69
56.27	0.89	8.206	5.017	-3.19	4.08
56.38	0.41	8.282	5.026	-3.26	3.67
56.46	0.50	8.335	5.033	-3.30	3.80
56.59	0.56	8.416	5.043	-3.37	3.93
56.68	0.49	8.475	5.050	-3.43	3.92
56.76	0.33	8.533	5.057	-3.48	3.81
56.86	0.74	8.600	5.065	-3.54	4.28
56.96	0.69	8.664	5.073	-3.59	4.28
57.05	1.17	8.726	5.080	-3.65	4.82
57.16	1.06	8.800	5.089	-3.71	4.77
57.27	1.97	8.869	5.098	-3.77	5.74
57.36	2.53	8.932	5.105	-3.83	6.36
57.47	3.20	9.001	5.114	-3.89	7.09
57.56	1.57	9.063	5.121	-3.94	5.51
57.67	1.34	9.139	5.131	-4.01	5.35
57.75	0.00	9.190	5.137	-4.05	4.05
57.85	1.26	9.258	5.145	-4.11	5.37
57.95	1.60	9.323	5.153	-4.17	5.77
58.06	3.13	9.398	5.162	-4.24	7.37
58.19	3.19	9.479	5.172	-4.31	7.50
58.29	0.69	9.546	5.180	-4.37	5.06
58.39	1.09	9.612	5.188	-4.42	5.51
58.46	0.29	9.660	5.194	-4.47	4.76
58.60	0.61	9.753	5.487	-4.27	4.88
58.67	0.45	9.797	5.628	-4.17	4.62
58.77	0.00	9.866	5.845	-4.02	4.02
58.90	0.54	9.951	6.115	-3.84	4.38
58.99	0.37	10.015	6.316	-3.70	4.07

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
59.05	0.40	10.055	6.442	-3.61	4.01
59.18	0.81	10.141	6.715	-3.43	4.24
59.28	1.30	10.205	6.918	-3.29	4.59
59.38	1.59	10.269	7.121	-3.15	4.74
59.46	1.47	10.325	7.298	-3.03	4.50
59.60	1.76	10.418	7.593	-2.83	4.59
59.66	1.79	10.460	7.725	-2.74	4.53
59.80	1.19	10.552	8.015	-2.54	3.73
59.85	1.42	10.588	8.130	-2.46	3.88
59.95	3.56	10.652	8.332	-2.32	5.88
60.09	2.22	10.746	8.631	-2.12	4.34
60.15	2.35	10.785	8.754	-2.03	4.38
60.28	0.79	10.870	9.024	-1.85	2.64
60.38	0.79	10.935	9.229	-1.71	2.50
60.47	1.06	10.999	9.432	-1.57	2.63
60.57	5.53	11.066	9.644	-1.42	6.95
60.68	0.38	11.136	9.864	-1.27	1.65
60.76	0.74	11.192	10.042	-1.15	1.89
60.91	1.32	11.247	10.101	-1.15	2.47
61.01	0.25	11.287	10.143	-1.14	1.39
61.06	0.01	11.305	10.162	-1.14	1.15
61.16	0.85	11.344	10.204	-1.14	1.99
61.28	0.95	11.391	10.254	-1.14	2.09
61.37	0.03	11.426	10.292	-1.13	1.16
61.45	0.00	11.457	10.324	-1.13	1.13
61.57	1.20	11.505	10.375	-1.13	2.33
61.67	0.92	11.540	10.413	-1.13	2.05
61.78	0.97	11.585	10.460	-1.12	2.09
61.89	0.66	11.627	10.505	-1.12	1.78

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
61.98	0.75	11.660	10.540	-1.12	1.87
62.08	0.16	11.701	10.584	-1.12	1.28
62.15	0.41	11.728	10.613	-1.12	1.53
62.30	0.44	11.785	10.673	-1.11	1.55
62.35	0.50	11.806	10.695	-1.11	1.61
62.45	0.52	11.843	10.735	-1.11	1.63
62.57	1.10	11.890	10.785	-1.10	2.20
62.75	1.73	11.960	10.859	-1.10	2.83
62.90	2.55	12.014	10.917	-1.10	3.65
62.99	3.67	12.050	10.956	-1.09	4.76
63.08	4.70	12.087	10.995	-1.09	5.79
63.16	3.37	12.118	11.028	-1.09	4.46
63.26	3.20	12.155	11.068	-1.09	4.29
63.36	2.41	12.194	11.108	-1.09	3.50
63.45	2.20	12.229	11.146	-1.08	3.28
63.57	2.15	12.275	11.195	-1.08	3.23
63.67	2.32	12.314	11.237	-1.08	3.40
63.79	2.54	12.360	11.285	-1.07	3.61
63.84	2.44	12.379	11.306	-1.07	3.51
63.88	2.93	12.396	11.324	-1.07	4.00
64.00	2.28	12.439	11.370	-1.07	3.35
64.10	2.27	12.478	11.411	-1.07	3.34
64.19	2.77	12.512	11.448	-1.06	3.83
64.30	3.21	12.556	11.494	-1.06	4.27
64.38	0.84	12.586	11.526	-1.06	1.90
64.49	1.18	12.628	11.571	-1.06	2.24
64.59	1.41	12.668	11.613	-1.05	2.46
64.68	1.77	12.704	11.651	-1.05	2.82
64.77	1.15	12.738	11.688	-1.05	2.20

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
64.87	0.58	12.776	11.728	-1.05	1.63
64.97	0.44	12.815	11.770	-1.05	1.49
65.05	0.71	12.847	11.804	-1.04	1.75
65.16	1.52	12.888	11.848	-1.04	2.56
65.26	2.43	12.928	11.890	-1.04	3.47
65.35	1.85	12.962	11.927	-1.04	2.89
65.48	2.78	13.013	11.981	-1.03	3.81
65.56	2.00	13.041	12.010	-1.03	3.03
65.67	2.73	13.083	12.055	-1.03	3.76
65.75	2.87	13.117	12.091	-1.03	3.90
65.88	0.82	13.165	12.143	-1.02	1.84
65.96	1.79	13.197	12.177	-1.02	2.81
66.08	2.24	13.242	12.224	-1.02	3.26
66.12	2.50	13.260	12.244	-1.02	3.52
66.17	2.44	13.278	12.262	-1.02	3.46
66.27	2.49	13.316	12.303	-1.01	3.50
66.39	4.58	13.364	12.354	-1.01	5.59
66.48	4.28	13.397	12.389	-1.01	5.29
66.57	3.42	13.430	12.425	-1.01	4.43
66.66	0.30	13.466	12.462	-1.00	1.30
66.75	0.66	13.503	12.502	-1.00	1.66
66.89	1.02	13.554	12.556	-1.00	2.02
66.98	1.12	13.591	12.596	-1.00	2.12
67.08	0.26	13.628	12.635	-0.99	1.25
67.20	0.61	13.674	12.684	-0.99	1.60
67.28	0.50	13.705	12.717	-0.99	1.49
67.40	0.55	13.754	12.769	-0.98	1.53
67.49	0.63	13.789	12.806	-0.98	1.61
67.57	0.86	13.819	12.839	-0.98	1.84

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
67.68	1.84	13.860	12.882	-0.98	2.82
67.79	1.14	13.903	12.928	-0.98	2.12
67.87	1.13	13.933	12.960	-0.97	2.10
67.95	1.60	13.966	12.995	-0.97	2.57
68.07	1.73	14.009	13.041	-0.97	2.70
68.18	2.02	14.054	13.088	-0.97	2.99
68.26	1.84	14.084	13.120	-0.96	2.80
68.36	1.81	14.123	13.162	-0.96	2.77
68.46	1.54	14.162	13.204	-0.96	2.50
68.59	1.27	14.213	13.258	-0.96	2.23
68.67	3.43	14.242	13.289	-0.95	4.38
68.76	0.74	14.275	13.324	-0.95	1.69
68.89	0.46	14.327	13.379	-0.95	1.41
68.98	0.42	14.361	13.415	-0.95	1.37
69.06	0.38	14.394	13.450	-0.94	1.32
69.16	0.73	14.433	13.492	-0.94	1.67
69.28	0.35	14.476	13.538	-0.94	1.29
69.45	0.00	14.544	13.610	-0.93	0.93
69.73	0.58	14.651	13.724	-0.93	1.51
69.99	0.00	14.753	13.833	-0.92	0.92
70.25	0.49	14.853	13.939	-0.91	1.40
70.47	1.06	14.937	14.028	-0.91	1.97
70.74	1.45	15.043	14.141	-0.90	2.35
70.96	0.40	15.127	14.231	-0.90	1.30
71.27	0.38	15.247	14.358	-0.89	1.27
71.44	0.37	15.312	14.428	-0.88	1.25
71.70	0.85	15.410	14.532	-0.88	1.73
72.02	0.44	15.535	14.665	-0.87	1.31
72.26	0.38	15.628	14.764	-0.86	1.24

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
72.43	1.83	15.695	14.835	-0.86	2.69
72.66	0.45	15.782	14.929	-0.85	1.30
72.84	0.96	15.853	15.003	-0.85	1.81
73.07	0.40	15.941	15.098	-0.84	1.24
73.32	0.79	16.034	15.197	-0.84	1.63
73.48	0.40	16.099	15.266	-0.83	1.23
73.50	0.00	16.107	15.274	-0.83	0.83
73.63	0.35	16.155	15.325	-0.83	1.18
73.79	0.98	16.217	15.392	-0.83	1.81
73.98	1.20	16.292	15.471	-0.82	2.02
74.08	1.26	16.328	15.510	-0.82	2.08
74.20	1.26	16.377	15.561	-0.82	2.08
74.28	1.37	16.405	15.592	-0.81	2.18
74.35	1.28	16.434	15.622	-0.81	2.09
74.50	0.90	16.491	15.683	-0.81	1.71
74.66	0.66	16.553	15.749	-0.80	1.46
74.86	1.09	16.631	15.832	-0.80	1.89
75.03	1.48	16.695	15.900	-0.79	2.27
75.19	0.51	16.758	15.967	-0.79	1.30
75.46	0.48	16.860	16.076	-0.78	1.26
75.71	0.63	16.959	16.181	-0.78	1.41
75.92	0.67	17.041	16.269	-0.77	1.44
76.06	4.52	17.092	16.323	-0.77	5.29
76.24	1.60	17.162	16.397	-0.76	2.36
76.48	0.47	17.255	16.496	-0.76	1.23
76.75	0.54	17.360	16.608	-0.75	1.29
76.92	0.00	17.426	16.678	-0.75	0.75
77.01	0.41	17.458	16.713	-0.75	1.16
77.30	0.50	17.570	16.832	-0.74	1.24

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
77.50	0.88	17.650	16.916	-0.73	1.61
77.72	0.00	17.734	17.006	-0.73	0.73
77.75	0.45	17.746	17.018	-0.73	1.18
77.85	0.00	17.783	17.058	-0.72	0.72
77.89	0.00	17.800	17.076	-0.72	0.72
78.10	0.53	17.881	17.163	-0.72	1.25
78.24	0.71	17.936	17.221	-0.71	1.42
78.48	0.53	18.026	17.317	-0.71	1.24
78.76	0.58	18.136	17.434	-0.70	1.28
78.98	0.36	18.221	17.524	-0.70	1.06
79.14	0.37	18.283	17.591	-0.69	1.06
79.26	0.40	18.329	17.640	-0.69	1.09
79.44	0.67	18.398	17.713	-0.68	1.35
79.65	1.92	18.479	17.800	-0.68	2.60
79.86	0.80	18.558	17.883	-0.67	1.47
80.13	0.54	18.662	17.994	-0.67	1.21
80.24	1.62	18.707	18.042	-0.67	2.29
80.49	0.45	18.802	18.143	-0.66	1.11
80.72	0.67	18.891	18.238	-0.65	1.32
80.84	0.41	18.937	18.286	-0.65	1.06
81.03	0.44	19.010	18.364	-0.65	1.09
81.26	0.93	19.101	18.462	-0.64	1.57
81.56	0.51	19.217	18.585	-0.63	1.14
81.76	0.90	19.293	18.666	-0.63	1.53
81.93	0.48	19.356	18.733	-0.62	1.10
82.23	0.46	19.474	18.858	-0.62	1.08
82.37	0.43	19.529	18.917	-0.61	1.04
82.51	0.47	19.583	18.975	-0.61	1.08
82.83	0.72	19.703	19.103	-0.60	1.32

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
82.95	0.53	19.752	19.154	-0.60	1.13
83.24	0.81	19.864	19.273	-0.59	1.40
83.35	1.08	19.907	19.319	-0.59	1.67
83.57	1.02	19.990	19.408	-0.58	1.60
83.85	0.40	20.098	19.523	-0.58	0.98
84.06	0.75	20.180	19.610	-0.57	1.32
84.23	0.99	20.227	19.619	-0.61	1.60
84.43	0.57	20.282	19.630	-0.65	1.22
84.55	1.05	20.317	19.636	-0.68	1.73
84.74	0.94	20.369	19.646	-0.72	1.66
84.89	0.44	20.409	19.654	-0.76	1.20
84.95	1.09	20.427	19.657	-0.77	1.86
84.97	1.17	20.433	19.659	-0.77	1.94
85.00	1.01	20.442	19.660	-0.78	1.79
85.05	0.45	20.455	19.663	-0.79	1.24
85.10	0.00	20.467	19.665	-0.80	0.80
85.11	0.45	20.471	19.666	-0.81	1.26
85.20	1.17	20.496	19.671	-0.83	2.00
85.34	0.88	20.535	19.678	-0.86	1.74
86.50	0.38	20.857	19.740	-1.12	1.50
86.59	1.00	20.882	19.744	-1.14	2.14
88.29	0.48	21.353	19.835	-1.52	2.00
88.29	0.72	21.354	19.835	-1.52	2.24
88.35	1.08	21.371	19.838	-1.53	2.61
88.45	0.49	21.399	19.843	-1.56	2.05
88.52	0.47	21.416	19.847	-1.57	2.04
88.56	0.40	21.429	19.849	-1.58	1.98
88.72	1.00	21.473	19.858	-1.62	2.62
89.50	0.42	21.689	19.899	-1.79	2.21

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
89.57	0.60	21.708	19.903	-1.81	2.41
89.71	0.36	21.748	19.910	-1.84	2.20
89.87	0.43	21.793	19.919	-1.87	2.30
90.04	0.50	21.840	19.928	-1.91	2.41
90.43	0.36	21.948	19.949	-2.00	2.36
90.66	0.43	22.012	19.961	-2.05	2.48
90.92	0.50	22.084	19.975	-2.11	2.61
91.13	0.76	22.142	19.986	-2.16	2.92
91.34	0.55	22.201	19.997	-2.20	2.75
91.51	0.48	22.246	20.006	-2.24	2.72
91.71	0.42	22.303	20.017	-2.29	2.71
91.77	0.63	22.320	20.020	-2.30	2.93
91.85	0.32	22.341	20.014	-2.33	2.65
91.91	0.90	22.358	20.010	-2.35	3.25
91.99	1.26	22.379	20.004	-2.38	3.64
92.12	2.54	22.417	19.993	-2.42	4.96
92.26	2.20	22.455	19.983	-2.47	4.67
92.39	0.88	22.491	19.973	-2.52	3.40
92.54	1.45	22.533	19.961	-2.57	4.02
92.59	1.03	22.546	19.958	-2.59	3.62
92.66	0.91	22.566	19.952	-2.61	3.52
92.75	2.02	22.592	19.945	-2.65	4.67
92.92	1.98	22.637	19.933	-2.70	4.68
93.06	0.97	22.677	19.922	-2.76	3.73
93.27	0.42	22.735	19.906	-2.83	3.25
93.45	0.51	22.786	19.892	-2.89	3.40
93.71	0.48	22.858	19.872	-2.99	3.47
93.80	1.07	22.882	19.865	-3.02	4.09
93.88	0.47	22.904	19.859	-3.04	3.51

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
93.99	0.85	22.934	19.851	-3.08	3.93
94.18	0.77	22.987	19.836	-3.15	3.92
94.35	0.62	23.034	19.823	-3.21	3.83
94.41	0.96	23.050	19.819	-3.23	4.19
94.63	0.53	23.112	19.802	-3.31	3.84
94.85	1.06	23.173	19.785	-3.39	4.45
95.09	0.40	23.242	19.766	-3.48	3.88
95.24	0.53	23.282	19.755	-3.53	4.06
95.39	0.70	23.324	19.743	-3.58	4.28
95.52	1.28	23.360	19.734	-3.63	4.91
95.65	1.80	23.397	19.723	-3.67	5.47
95.81	0.51	23.441	19.711	-3.73	4.24
96.00	0.43	23.494	19.697	-3.80	4.23
96.21	0.55	23.551	19.681	-3.87	4.42
96.39	1.04	23.601	19.667	-3.93	4.97
96.54	1.18	23.644	19.656	-3.99	5.17
96.64	0.48	23.670	19.648	-4.02	4.50
96.70	0.00	23.686	19.644	-4.04	4.04
96.70	0.49	23.688	19.643	-4.05	4.54
96.76	1.03	23.705	19.639	-4.07	5.10
96.82	0.46	23.721	19.634	-4.09	4.55
96.96	0.33	23.758	19.624	-4.13	4.46
96.99	0.49	23.767	19.622	-4.15	4.64
97.14	0.27	23.809	19.610	-4.20	4.47
97.22	0.45	23.831	20.059	-3.77	4.22
97.25	0.12	23.839	19.665	-4.17	4.29
97.37	0.14	23.875	19.729	-4.15	4.29
97.42	0.00	23.887	19.752	-4.14	4.14
97.47	0.00	23.902	19.778	-4.12	4.12

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
97.54	0.00	23.919	19.810	-4.11	4.11
97.61	0.47	23.939	19.845	-4.09	4.56
97.68	0.49	23.959	19.882	-4.08	4.57
97.74	1.13	23.975	19.910	-4.06	5.19
97.77	0.00	23.985	19.928	-4.06	4.06
97.83	0.00	24.001	19.958	-4.04	4.04
97.86	0.00	24.010	19.974	-4.04	4.04
97.88	0.28	24.016	19.984	-4.03	4.31
97.93	0.40	24.028	20.006	-4.02	4.42
97.95	0.00	24.035	20.018	-4.02	4.02
97.96	0.00	24.038	20.024	-4.01	4.01
97.98	0.00	24.044	20.035	-4.01	4.01
98.02	0.27	24.053	20.052	-4.00	4.27
98.04	0.00	24.058	20.061	-4.00	4.00
98.08	0.00	24.069	20.081	-3.99	3.99
98.13	0.00	24.085	20.111	-3.97	3.97
98.20	0.39	24.102	20.141	-3.96	4.35
98.25	1.06	24.117	20.168	-3.95	5.01
98.32	1.17	24.138	20.206	-3.93	5.10
98.35	0.77	24.146	20.220	-3.93	4.70
98.37	0.68	24.151	20.230	-3.92	4.60
98.39	0.00	24.156	20.239	-3.92	3.92
98.42	0.00	24.166	20.256	-3.91	3.91
98.49	0.28	24.183	20.288	-3.90	4.18
98.54	0.00	24.197	20.313	-3.88	3.88
98.61	0.55	24.216	20.348	-3.87	4.42
98.66	0.25	24.231	20.375	-3.86	4.11
98.68	0.37	24.237	20.385	-3.85	4.22
98.76	0.59	24.259	20.426	-3.83	4.42

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
98.80	0.47	24.270	20.445	-3.83	4.30
98.93	0.79	24.305	20.508	-3.80	4.59
98.99	0.69	24.322	20.538	-3.78	4.47
99.05	0.51	24.338	20.568	-3.77	4.28
99.11	0.00	24.355	20.599	-3.76	3.76
99.12	0.00	24.358	20.605	-3.75	3.75
99.15	0.00	24.366	20.618	-3.75	3.75
99.20	0.30	24.380	20.645	-3.74	4.04
99.28	0.00	24.404	20.688	-3.72	3.72
99.34	0.00	24.420	20.716	-3.70	3.70
99.38	0.50	24.432	20.738	-3.69	4.19
99.44	0.74	24.448	20.768	-3.68	4.42
99.51	0.73	24.466	20.800	-3.67	4.40
99.56	0.00	24.481	20.828	-3.65	3.65
99.59	0.00	24.488	20.840	-3.65	3.65
99.64	0.00	24.503	20.866	-3.64	3.64
99.70	0.00	24.520	20.897	-3.62	3.62
99.77	0.26	24.540	20.934	-3.61	3.87
99.83	0.67	24.556	20.963	-3.59	4.26
99.89	0.59	24.571	20.991	-3.58	4.17
99.95	0.65	24.589	21.023	-3.57	4.22
100.00	0.65	24.604	21.050	-3.55	4.20
100.05	0.69	24.618	21.075	-3.54	4.23
100.10	0.76	24.632	21.100	-3.53	4.29
100.16	1.07	24.648	21.130	-3.52	4.59
100.21	1.18	24.663	21.156	-3.51	4.69
100.27	1.28	24.678	21.183	-3.49	4.77
100.32	1.43	24.693	21.210	-3.48	4.91
100.37	1.37	24.706	21.235	-3.47	4.84

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
100.42	1.45	24.719	21.258	-3.46	4.91
100.47	0.90	24.733	21.283	-3.45	4.35
100.52	1.06	24.747	21.309	-3.44	4.50
100.57	0.73	24.762	21.336	-3.43	4.16
100.63	0.63	24.777	21.363	-3.41	4.04
100.67	0.92	24.790	21.386	-3.40	4.32
100.77	1.59	24.816	21.434	-3.38	4.97
100.86	0.26	24.840	21.478	-3.36	3.62
100.95	0.00	24.867	21.526	-3.34	3.34
100.98	0.00	24.874	21.539	-3.34	3.34
101.02	0.38	24.887	21.562	-3.32	3.70
101.08	0.35	24.903	21.590	-3.31	3.66
101.22	2.11	24.942	21.661	-3.28	5.39
101.30	0.27	24.964	21.702	-3.26	3.53
101.34	0.00	24.976	21.723	-3.25	3.25
101.36	0.38	24.979	21.729	-3.25	3.63
101.37	0.39	24.983	21.737	-3.25	3.64
101.46	0.00	25.008	21.781	-3.23	3.23
101.56	0.01	25.035	21.830	-3.20	3.21
101.93	0.48	25.138	22.016	-3.12	3.60
101.94	0.39	25.141	22.022	-3.12	3.51
101.95	0.29	25.143	22.025	-3.12	3.41
102.04	0.42	25.168	22.071	-3.10	3.52
102.21	0.48	25.215	22.156	-3.06	3.54
102.34	0.48	25.253	22.224	-3.03	3.51
102.48	0.57	25.292	22.296	-3.00	3.57
102.68	0.73	25.346	22.394	-2.95	3.68
102.78	0.75	25.375	22.446	-2.93	3.68
102.92	0.74	25.414	22.515	-2.90	3.64

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
102.94	0.77	25.418	22.523	-2.89	3.66
102.96	0.63	25.423	22.533	-2.89	3.52
103.05	0.40	25.449	22.580	-2.87	3.27
103.16	0.33	25.480	22.635	-2.84	3.17
103.32	0.00	25.524	22.716	-2.81	2.81
103.34	0.00	25.530	22.726	-2.80	2.80
103.39	0.00	25.544	22.752	-2.79	2.79
103.43	0.56	25.553	22.769	-2.78	3.34
103.45	0.42	25.561	22.783	-2.78	3.20
103.64	0.00	25.613	22.876	-2.74	2.74
103.67	0.00	25.621	22.890	-2.73	2.73
103.82	0.64	25.664	22.969	-2.70	3.34
103.85	0.49	25.672	22.983	-2.69	3.18
104.04	0.60	25.723	23.076	-2.65	3.25
104.07	0.68	25.731	23.091	-2.64	3.32
104.23	0.00	25.777	23.174	-2.60	2.60
104.34	0.00	25.806	23.227	-2.58	2.58
104.35	0.27	25.811	23.235	-2.58	2.85
104.53	0.58	25.859	23.321	-2.54	3.12
104.56	0.70	25.867	23.337	-2.53	3.23
104.74	0.59	25.918	23.428	-2.49	3.08
104.77	0.35	25.926	23.444	-2.48	2.83
104.92	0.58	25.969	23.522	-2.45	3.03
104.97	1.04	25.981	23.543	-2.44	3.48
105.13	0.50	26.026	23.624	-2.40	2.90
105.17	0.88	26.036	23.643	-2.39	3.27
105.35	0.00	26.087	23.735	-2.35	2.35
105.37	0.25	26.094	23.748	-2.35	2.60
105.84	0.46	26.224	23.983	-2.24	2.70

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
105.86	0.49	26.228	23.990	-2.24	2.73
106.05	0.34	26.281	24.087	-2.19	2.53
106.05	0.82	26.282	24.088	-2.19	3.01
106.22	0.51	26.329	24.173	-2.16	2.67
106.26	0.61	26.341	24.194	-2.15	2.76
106.43	0.30	26.387	24.278	-2.11	2.41
106.46	0.29	26.396	24.294	-2.10	2.39
106.63	0.31	26.444	24.381	-2.06	2.37
106.66	0.29	26.450	24.392	-2.06	2.35
106.85	0.59	26.503	24.488	-2.02	2.61
106.85	0.63	26.504	24.491	-2.01	2.64
107.03	0.53	26.554	24.581	-1.97	2.50
107.05	0.56	26.560	24.592	-1.97	2.53
107.23	0.61	26.608	24.678	-1.93	2.54
107.33	0.32	26.638	24.733	-1.91	2.23
107.37	0.44	26.648	24.751	-1.90	2.34
107.55	0.00	26.697	24.840	-1.86	1.86
107.57	0.00	26.704	24.852	-1.85	1.85
107.58	0.00	26.705	24.854	-1.85	1.85
107.59	0.00	26.710	24.862	-1.85	1.85
107.61	0.00	26.715	24.871	-1.84	1.84
107.65	0.13	26.725	24.889	-1.84	1.97
107.67	0.63	26.732	24.903	-1.83	2.46
107.71	0.88	26.741	24.920	-1.82	2.70
107.72	0.00	26.745	24.927	-1.82	1.82
107.74	0.04	26.750	24.935	-1.82	1.86
107.75	0.00	26.753	24.940	-1.81	1.81
107.75	0.00	26.755	24.944	-1.81	1.81
107.94	1.42	26.806	25.036	-1.77	3.19

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
107.96	0.32	26.812	25.047	-1.76	2.08
108.14	0.00	26.863	25.139	-1.72	1.72
108.16	0.00	26.866	25.145	-1.72	1.72
108.33	1.22	26.916	25.235	-1.68	2.90
108.35	1.52	26.921	25.245	-1.68	3.20
108.49	1.06	26.959	24.253	-2.71	3.77
108.56	0.43	26.978	25.348	-1.63	2.06
109.10	0.72	27.185	25.561	-1.62	2.34
109.19	0.39	27.218	25.595	-1.62	2.01
109.28	0.00	27.254	25.633	-1.62	1.62
109.44	0.01	27.315	25.695	-1.62	1.63
109.46	0.52	27.324	25.704	-1.62	2.14
109.56	0.02	27.358	25.740	-1.62	1.64
109.74	0.45	27.430	25.814	-1.62	2.07
109.79	0.31	27.446	25.830	-1.62	1.93
109.93	0.01	27.501	25.887	-1.61	1.62
109.96	0.67	27.511	25.897	-1.61	2.28
110.18	0.41	27.598	25.987	-1.61	2.02
110.24	0.29	27.620	26.009	-1.61	1.90
110.31	0.36	27.645	26.034	-1.61	1.97
110.38	0.02	27.672	26.062	-1.61	1.63
110.53	0.00	27.731	26.123	-1.61	1.61
110.56	0.00	27.740	26.133	-1.61	1.61
110.74	0.30	27.810	26.205	-1.61	1.91
110.78	0.00	27.824	26.219	-1.60	1.60
110.90	0.30	27.873	26.269	-1.60	1.90
110.95	0.40	27.892	26.289	-1.60	2.00
111.13	0.00	27.958	26.357	-1.60	1.60
111.15	0.74	27.968	26.367	-1.60	2.34

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
111.30	0.00	28.024	26.425	-1.60	1.60
111.35	0.29	28.045	26.447	-1.60	1.89
111.64	0.31	28.154	26.559	-1.60	1.91
111.71	0.00	28.182	26.588	-1.59	1.59
111.77	0.32	28.205	26.612	-1.59	1.91
111.82	0.01	28.224	26.631	-1.59	1.60
111.86	0.32	28.238	26.645	-1.59	1.91
111.96	0.30	28.277	26.686	-1.59	1.89
112.01	0.30	28.296	26.705	-1.59	1.89
112.08	0.36	28.323	26.733	-1.59	1.95
112.18	0.68	28.360	26.771	-1.59	2.27
112.24	1.01	28.382	26.793	-1.59	2.60
112.26	0.00	28.391	26.803	-1.59	1.59
112.29	0.02	28.400	26.812	-1.59	1.61
112.37	0.91	28.433	26.846	-1.59	2.50
112.48	0.16	28.476	26.891	-1.59	1.75
112.54	0.01	28.497	26.912	-1.58	1.59
112.60	0.40	28.519	26.935	-1.58	1.98
112.63	0.00	28.531	26.947	-1.58	1.58
112.67	0.12	28.545	26.962	-1.58	1.70
112.76	0.00	28.582	26.999	-1.58	1.58
112.90	0.25	28.634	27.053	-1.58	1.83
112.96	0.51	28.658	27.078	-1.58	2.09
113.13	0.26	28.723	27.145	-1.58	1.84
113.16	0.00	28.735	27.157	-1.58	1.58
113.32	0.25	28.797	27.221	-1.58	1.83
113.35	0.41	28.807	27.231	-1.58	1.99
113.54	0.00	28.878	27.304	-1.57	1.57
113.57	0.00	28.890	27.317	-1.57	1.57

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
113.72	0.42	28.949	27.378	-1.57	1.99
113.78	0.49	28.969	27.398	-1.57	2.06
114.05	0.76	29.073	27.505	-1.57	2.33
114.09	0.66	29.089	27.522	-1.57	2.23
114.13	0.50	29.105	27.538	-1.57	2.07
114.16	0.03	29.117	27.550	-1.57	1.60
114.34	0.15	29.183	27.619	-1.56	1.71
114.35	0.18	29.188	27.624	-1.56	1.74
114.51	0.74	29.249	27.687	-1.56	2.30
114.56	1.10	29.268	27.706	-1.56	2.66
114.61	0.79	29.288	27.727	-1.56	2.35
114.66	0.60	29.307	27.746	-1.56	2.16
114.85	0.83	29.378	27.820	-1.56	2.39
114.90	1.09	29.398	27.840	-1.56	2.65
114.94	1.30	29.413	27.856	-1.56	2.86
114.98	1.22	29.427	27.870	-1.56	2.78
115.13	2.05	29.486	27.930	-1.56	3.61
115.18	1.85	29.504	27.949	-1.55	3.40
115.35	2.55	29.568	28.015	-1.55	4.10
115.36	2.73	29.572	28.019	-1.55	4.28
115.54	2.48	29.644	28.093	-1.55	4.03
115.61	1.14	29.668	28.117	-1.55	2.69
115.67	0.97	29.692	28.143	-1.55	2.52
115.85	0.00	29.759	28.212	-1.55	1.55
115.86	0.00	29.765	28.218	-1.55	1.55
115.99	0.31	29.813	28.267	-1.55	1.86
116.07	0.00	29.845	28.300	-1.54	1.54
116.19	0.31	29.892	28.349	-1.54	1.85
116.43	0.33	29.983	28.443	-1.54	1.87

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
116.47	0.00	29.998	28.458	-1.54	1.54
116.55	0.29	30.028	28.489	-1.54	1.83
116.68	0.00	30.077	28.539	-1.54	1.54
116.84	0.52	30.139	28.603	-1.54	2.06
116.86	0.00	30.145	28.609	-1.54	1.54
117.00	0.20	30.200	28.666	-1.53	1.73
117.05	0.64	30.219	28.685	-1.53	2.17
117.24	0.45	30.290	28.758	-1.53	1.98
117.27	0.62	30.303	28.772	-1.53	2.15
117.43	0.00	30.365	28.836	-1.53	1.53
117.55	0.00	30.411	28.883	-1.53	1.53
117.76	0.05	30.491	28.966	-1.53	1.58
117.87	0.53	30.533	29.008	-1.52	2.05
117.92	0.02	30.549	29.025	-1.52	1.54
117.96	0.32	30.564	29.041	-1.52	1.84
118.08	0.44	30.613	29.091	-1.52	1.96
118.13	0.12	30.631	29.110	-1.52	1.64
118.21	0.00	30.661	29.141	-1.52	1.52
118.26	0.04	30.679	29.159	-1.52	1.56
118.32	0.32	30.703	29.183	-1.52	1.84
118.38	0.44	30.727	29.209	-1.52	1.96
118.42	0.26	30.743	29.224	-1.52	1.78
118.49	0.24	30.766	29.249	-1.52	1.76
118.55	0.29	30.790	29.273	-1.52	1.81
118.60	0.37	30.811	29.295	-1.52	1.89
118.64	0.44	30.824	29.308	-1.52	1.96
118.66	0.41	30.831	29.316	-1.52	1.93
118.68	0.46	30.840	29.325	-1.52	1.98
118.70	0.13	30.848	29.333	-1.52	1.65

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
118.72	0.00	30.857	29.343	-1.51	1.51
118.77	0.34	30.875	29.361	-1.51	1.85
118.82	0.06	30.893	29.379	-1.51	1.57
118.85	0.27	30.907	29.394	-1.51	1.78
118.98	0.51	30.956	29.444	-1.51	2.02
119.02	0.60	30.969	29.458	-1.51	2.11
119.05	0.00	30.981	29.470	-1.51	1.51
119.07	0.00	30.990	29.479	-1.51	1.51
119.17	0.06	31.027	29.517	-1.51	1.57
119.27	0.26	31.064	29.556	-1.51	1.77
119.38	0.00	31.107	29.600	-1.51	1.51
119.44	0.59	31.132	29.626	-1.51	2.10
119.52	0.54	31.160	29.654	-1.51	2.05
119.57	0.33	31.181	29.676	-1.51	1.84
119.61	0.00	31.197	29.693	-1.50	1.50
119.67	0.00	31.218	29.714	-1.50	1.50
119.83	0.00	31.278	29.776	-1.50	1.50
119.90	0.88	31.307	29.805	-1.50	2.38
119.97	0.00	31.332	29.832	-1.50	1.50
120.01	0.00	31.348	29.848	-1.50	1.50
120.08	0.40	31.375	29.875	-1.50	1.90
120.12	0.00	31.392	29.893	-1.50	1.50
120.19	0.35	31.417	29.919	-1.50	1.85
120.26	0.37	31.445	29.947	-1.50	1.87
120.35	0.47	31.479	29.982	-1.50	1.97
120.49	0.47	31.530	30.035	-1.49	1.96
120.55	0.35	31.556	30.062	-1.49	1.84
120.71	0.39	31.617	30.124	-1.49	1.88
120.78	0.23	31.642	30.150	-1.49	1.72

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
120.87	0.00	31.676	30.186	-1.49	1.49
120.94	0.00	31.704	30.215	-1.49	1.49
120.95	0.00	31.707	30.218	-1.49	1.49
121.09	0.00	31.761	30.273	-1.49	1.49
121.22	0.53	31.808	30.322	-1.49	2.02
121.28	0.00	31.831	30.346	-1.49	1.49
121.40	0.37	31.880	30.395	-1.48	1.85
121.46	0.49	31.900	30.417	-1.48	1.97
121.57	0.00	31.944	30.462	-1.48	1.48
121.70	0.00	31.994	30.513	-1.48	1.48
121.76	0.00	32.015	30.534	-1.48	1.48
121.90	0.56	32.069	30.590	-1.48	2.04
121.98	0.63	32.100	30.622	-1.48	2.11
122.08	0.19	32.140	30.663	-1.48	1.67
122.24	0.00	32.198	30.723	-1.47	1.47
122.26	0.00	32.207	30.732	-1.47	1.47
122.39	0.62	32.255	30.782	-1.47	2.09
122.46	0.54	32.283	30.811	-1.47	2.01
122.57	0.30	32.323	30.852	-1.47	1.77
122.67	0.36	32.364	30.894	-1.47	1.83
122.79	1.27	32.409	30.941	-1.47	2.74
122.86	0.98	32.437	30.969	-1.47	2.45
122.97	0.56	32.479	31.012	-1.47	2.03
123.18	0.48	32.556	31.092	-1.46	1.94
123.23	0.62	32.578	31.114	-1.46	2.08
123.29	0.00	32.598	31.135	-1.46	1.46
123.32	0.43	32.610	31.147	-1.46	1.89
123.40	1.35	32.643	31.181	-1.46	2.81
123.45	0.00	32.662	31.201	-1.46	1.46

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
123.56	0.00	32.702	31.242	-1.46	1.46
123.67	0.28	32.745	31.286	-1.46	1.74
123.79	0.71	32.791	31.334	-1.46	2.17
123.86	0.28	32.816	31.360	-1.46	1.74
123.96	0.00	32.854	31.399	-1.46	1.46
124.05	0.35	32.891	31.437	-1.45	1.80
124.18	0.36	32.939	31.486	-1.45	1.81
124.25	0.73	32.967	31.515	-1.45	2.18
124.40	0.00	33.022	31.572	-1.45	1.45
124.45	0.67	33.043	31.593	-1.45	2.12
124.59	1.15	33.097	31.649	-1.45	2.60
124.69	1.20	33.135	31.688	-1.45	2.65
124.77	0.34	33.163	31.717	-1.45	1.79
124.87	0.00	33.205	31.760	-1.45	1.45
124.95	0.58	33.234	31.790	-1.44	2.02
125.06	0.22	33.277	31.834	-1.44	1.66
125.18	0.00	33.321	31.880	-1.44	1.44
125.26	0.28	33.353	31.913	-1.44	1.72
125.41	0.46	33.409	31.970	-1.44	1.90
125.45	0.00	33.425	31.987	-1.44	1.44
125.56	0.00	33.467	32.029	-1.44	1.44
125.65	0.27	33.501	32.065	-1.44	1.71
125.75	0.28	33.540	32.105	-1.44	1.72
125.88	0.27	33.589	32.156	-1.43	1.70
126.00	0.43	33.635	32.202	-1.43	1.86
126.08	0.67	33.664	32.233	-1.43	2.10
126.16	0.62	33.696	32.266	-1.43	2.05
126.31	0.41	33.751	32.322	-1.43	1.84
126.38	0.00	33.778	32.350	-1.43	1.43

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
126.46	0.58	33.808	32.381	-1.43	2.01
126.57	0.51	33.850	32.425	-1.43	1.94
126.67	0.33	33.889	32.464	-1.42	1.75
126.79	0.22	33.936	32.513	-1.42	1.64
126.87	0.79	33.968	32.545	-1.42	2.21
126.98	0.00	34.006	32.585	-1.42	1.42
127.08	0.42	34.047	32.627	-1.42	1.84
127.16	0.00	34.079	32.659	-1.42	1.42
127.25	0.00	34.112	32.694	-1.42	1.42
127.37	0.00	34.156	32.740	-1.42	1.42
127.47	0.50	34.196	32.781	-1.42	1.92
127.57	0.00	34.234	32.820	-1.41	1.41
127.67	0.67	34.273	32.860	-1.41	2.08
127.76	0.00	34.304	32.892	-1.41	1.41
127.87	0.00	34.350	32.939	-1.41	1.41
128.00	0.34	34.398	32.988	-1.41	1.75
128.07	0.37	34.424	33.015	-1.41	1.78
128.16	0.30	34.457	33.049	-1.41	1.71
128.27	0.29	34.499	33.092	-1.41	1.70
128.41	0.30	34.555	33.151	-1.40	1.70
128.47	0.47	34.576	33.172	-1.40	1.87
128.52	0.00	34.594	33.191	-1.40	1.40
128.55	0.00	34.609	33.206	-1.40	1.40
128.57	0.00	34.613	33.210	-1.40	1.40
128.62	0.00	34.633	33.230	-1.40	1.40
128.69	0.00	34.660	33.258	-1.40	1.40
128.82	0.00	34.710	33.310	-1.40	1.40
128.87	0.03	34.731	33.331	-1.40	1.43
128.97	0.00	34.766	33.367	-1.40	1.40

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
129.07	0.00	34.805	33.408	-1.40	1.40
129.16	0.00	34.840	33.444	-1.40	1.40
129.26	0.00	34.878	33.483	-1.40	1.40
129.38	0.41	34.923	33.529	-1.39	1.80
129.44	0.40	34.945	33.552	-1.39	1.79
129.49	0.52	34.964	33.571	-1.39	1.91
129.52	0.58	34.978	33.586	-1.39	1.97
129.55	0.64	34.990	33.598	-1.39	2.03
129.57	0.28	34.996	33.604	-1.39	1.67
129.65	0.37	35.029	33.638	-1.39	1.76
129.76	0.00	35.070	33.680	-1.39	1.39
129.86	0.68	35.108	33.720	-1.39	2.07
129.93	0.54	35.135	33.748	-1.39	1.93
129.99	0.00	35.156	33.769	-1.39	1.39
130.05	0.00	35.181	33.795	-1.39	1.39
130.15	0.36	35.219	33.834	-1.39	1.75
130.34	0.64	35.290	33.907	-1.38	2.02
130.37	0.27	35.301	33.918	-1.38	1.65
130.49	0.28	35.348	33.967	-1.38	1.66
130.55	0.44	35.371	33.990	-1.38	1.82
130.65	1.06	35.410	34.031	-1.38	2.44
130.77	1.46	35.456	34.078	-1.38	2.84
130.88	1.28	35.498	34.121	-1.38	2.66
130.97	1.12	35.529	34.153	-1.38	2.50
131.06	0.87	35.564	34.189	-1.37	2.24
131.50	0.26	35.733	34.364	-1.37	1.63
131.65	0.36	35.788	34.420	-1.37	1.73
131.69	0.76	35.805	34.438	-1.37	2.13
131.72	0.00	35.819	34.451	-1.37	1.37

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
131.76	0.44	35.834	34.467	-1.37	1.81
131.88	0.56	35.878	34.513	-1.37	1.93
131.92	1.05	35.894	34.529	-1.37	2.42
131.95	1.48	35.906	34.541	-1.36	2.84
132.08	1.44	35.956	34.593	-1.36	2.80
132.19	0.84	35.995	34.633	-1.36	2.20
132.24	0.93	36.014	34.652	-1.36	2.29
132.26	1.24	36.024	34.663	-1.36	2.60
132.36	0.85	36.060	34.700	-1.36	2.21
132.48	0.00	36.108	34.749	-1.36	1.36
132.52	0.56	36.121	34.763	-1.36	1.92
132.55	2.72	36.135	34.777	-1.36	4.08
132.67	0.43	36.178	34.822	-1.36	1.79
132.80	0.40	36.230	34.875	-1.36	1.76
132.86	0.45	36.250	34.896	-1.35	1.80
133.06	0.41	36.330	34.977	-1.35	1.76
133.26	0.39	36.403	35.053	-1.35	1.74
133.48	0.96	36.467	35.067	-1.40	2.36
133.68	0.60	36.526	35.080	-1.45	2.05
133.74	0.47	36.541	35.084	-1.46	1.93
133.89	1.14	36.585	35.094	-1.49	2.63
134.13	0.44	36.653	35.109	-1.54	1.98
134.44	0.51	36.742	35.129	-1.61	2.12
134.76	0.36	36.836	35.150	-1.69	2.05
134.98	1.66	36.899	35.164	-1.74	3.40
135.10	0.38	36.934	35.172	-1.76	2.14
135.33	1.11	37.000	35.186	-1.81	2.92
135.52	0.86	37.053	35.198	-1.85	2.71
135.74	0.97	37.118	35.213	-1.91	2.88

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
135.99	0.00	37.188	35.228	-1.96	1.96
136.13	0.47	37.229	35.238	-1.99	2.46
136.30	0.75	37.278	35.248	-2.03	2.78
136.53	1.09	37.345	35.264	-2.08	3.17
136.72	0.99	37.398	35.275	-2.12	3.11
136.91	1.15	37.452	35.287	-2.16	3.31
137.16	0.47	37.524	35.304	-2.22	2.69
137.43	0.45	37.604	35.321	-2.28	2.73
137.60	0.00	37.651	35.332	-2.32	2.32
137.73	0.52	37.691	35.341	-2.35	2.87
137.87	0.39	37.730	35.349	-2.38	2.77
138.00	0.34	37.766	35.358	-2.41	2.75
138.14	0.64	37.807	35.367	-2.44	3.08
138.34	0.40	37.864	35.380	-2.48	2.88
138.39	0.40	37.878	35.383	-2.50	2.90
138.56	0.46	37.927	35.394	-2.53	2.99
138.76	0.39	37.984	35.406	-2.58	2.97
138.94	1.02	38.038	35.418	-2.62	3.64
139.13	3.00	38.091	35.430	-2.66	5.66
139.32	3.11	38.145	35.442	-2.70	5.81
139.58	1.00	38.222	35.459	-2.76	3.76
139.79	0.36	38.282	35.473	-2.81	3.17
140.05	0.37	38.357	35.490	-2.87	3.24
140.32	0.55	38.433	35.507	-2.93	3.48
140.57	0.74	38.506	35.523	-2.98	3.72
140.72	0.39	38.550	35.533	-3.02	3.41
140.83	1.11	38.580	35.540	-3.04	4.15
140.97	0.46	38.620	35.548	-3.07	3.53
141.15	0.81	38.672	35.560	-3.11	3.92

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
141.34	0.98	38.728	35.573	-3.16	4.14
141.54	0.63	38.784	35.585	-3.20	3.83
141.72	0.39	38.836	35.597	-3.24	3.63
141.84	0.46	38.871	35.605	-3.27	3.73
142.04	0.57	38.927	35.617	-3.31	3.88
142.20	0.45	38.975	35.628	-3.35	3.80
142.40	1.02	39.032	35.641	-3.39	4.41
142.56	0.00	39.079	35.651	-3.43	3.43
142.75	0.47	39.133	35.663	-3.47	3.94
142.99	0.00	39.200	35.678	-3.52	3.52
143.16	0.43	39.249	35.689	-3.56	3.99
143.33	0.40	39.298	35.700	-3.60	4.00
143.50	0.36	39.348	35.711	-3.64	4.00
143.64	0.00	39.389	35.720	-3.67	3.67
143.80	0.80	39.434	35.730	-3.70	4.50
143.88	1.05	39.457	35.735	-3.72	4.77
144.06	0.51	39.509	35.747	-3.76	4.27
144.22	1.11	39.556	35.757	-3.80	4.91
144.58	0.44	39.659	35.781	-3.88	4.32
144.80	0.57	39.723	35.795	-3.93	4.50
145.00	0.92	39.778	35.807	-3.97	4.89
145.20	0.82	39.837	35.820	-4.02	4.84
145.41	1.13	39.897	35.834	-4.06	5.19
145.74	0.46	39.992	35.855	-4.14	4.60
146.00	0.53	40.066	35.872	-4.19	4.72
146.28	0.35	40.148	35.890	-4.26	4.61
146.52	0.35	40.216	35.905	-4.31	4.66
146.75	0.46	40.282	35.920	-4.36	4.82
146.88	0.55	40.320	35.928	-4.39	4.94

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
146.95	0.71	40.339	35.932	-4.41	5.12
147.01	0.65	40.357	35.937	-4.42	5.07
147.06	0.00	40.370	35.940	-4.43	4.43
147.12	0.35	40.388	35.944	-4.44	4.79
147.18	0.35	40.406	35.948	-4.46	4.81
147.21	0.33	40.414	35.949	-4.46	4.79
147.26	0.69	40.428	35.953	-4.48	5.17
147.36	0.00	40.456	35.959	-4.50	4.50
147.49	0.00	40.495	35.967	-4.53	4.53
147.57	0.31	40.516	35.972	-4.54	4.85
147.71	0.00	40.557	35.981	-4.58	4.58
147.77	0.26	40.575	35.985	-4.59	4.85
147.87	0.25	40.603	35.992	-4.61	4.86
147.96	0.00	40.629	35.997	-4.63	4.63
148.06	0.30	40.660	36.004	-4.66	4.96
148.17	0.00	40.690	36.011	-4.68	4.68
148.35	0.48	40.741	36.022	-4.72	5.20
148.38	0.38	40.749	36.024	-4.73	5.11
148.52	0.65	40.789	36.033	-4.76	5.41
148.57	1.07	40.805	36.037	-4.77	5.84
148.74	0.81	40.855	36.048	-4.81	5.62
148.76	0.38	40.860	36.049	-4.81	5.19
148.87	0.50	40.892	36.056	-4.84	5.34
148.91	0.00	40.902	36.058	-4.84	4.84
148.96	0.29	40.916	36.062	-4.85	5.14
149.14	0.26	40.968	36.073	-4.90	5.16
149.19	0.32	40.983	36.077	-4.91	5.23
149.24	0.00	40.999	36.080	-4.92	4.92
149.30	0.00	41.014	36.083	-4.93	4.93

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
149.34	0.00	41.028	36.086	-4.94	4.94
149.39	0.32	41.040	36.089	-4.95	5.27
149.44	0.26	41.055	36.093	-4.96	5.22
149.49	0.55	41.070	36.096	-4.97	5.52
149.55	0.27	41.087	36.100	-4.99	5.26
149.60	0.43	41.103	36.103	-5.00	5.43
149.67	0.49	41.121	36.107	-5.01	5.50
149.74	0.45	41.140	36.112	-5.03	5.48
149.79	0.35	41.157	36.115	-5.04	5.39
149.84	0.28	41.171	36.118	-5.05	5.33
149.89	0.27	41.183	36.121	-5.06	5.33
149.94	0.27	41.199	36.125	-5.07	5.34
149.98	0.30	41.211	36.127	-5.08	5.38
150.04	0.44	41.228	36.131	-5.10	5.54
150.09	0.33	41.242	36.134	-5.11	5.44
150.12	0.38	41.252	36.137	-5.12	5.50
150.17	0.54	41.266	36.140	-5.13	5.67
150.22	0.25	41.280	36.143	-5.14	5.39
150.28	0.71	41.297	36.147	-5.15	5.86
150.32	0.94	41.310	36.149	-5.16	6.10
150.38	0.90	41.324	36.153	-5.17	6.07
150.46	0.25	41.348	36.158	-5.19	5.44
150.55	1.49	41.376	36.164	-5.21	6.70
150.67	0.95	41.410	36.172	-5.24	6.19
150.71	0.85	41.422	36.174	-5.25	6.10
150.76	1.39	41.435	36.178	-5.26	6.65
150.88	2.08	41.468	36.185	-5.28	7.36
150.99	2.15	41.500	36.192	-5.31	7.46
151.06	2.57	41.522	36.197	-5.33	7.90

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
151.18	2.52	41.557	36.205	-5.35	7.87
151.24	1.43	41.574	36.209	-5.37	6.80
151.27	0.26	41.582	36.210	-5.37	5.63
151.31	0.25	41.592	36.213	-5.38	5.63
151.37	0.35	41.610	36.217	-5.39	5.74
151.44	0.25	41.631	36.221	-5.41	5.66
151.49	0.25	41.644	36.224	-5.42	5.67
151.53	0.27	41.657	36.227	-5.43	5.70
151.58	0.33	41.670	36.230	-5.44	5.77
151.62	0.43	41.683	36.233	-5.45	5.88
151.67	1.00	41.697	36.236	-5.46	6.46
151.73	1.32	41.713	36.240	-5.47	6.79
151.78	1.16	41.729	36.243	-5.49	6.65
151.83	0.39	41.741	36.246	-5.50	5.89
151.87	0.44	41.755	36.249	-5.51	5.95
151.91	0.49	41.765	36.251	-5.51	6.00
151.95	0.46	41.777	36.254	-5.52	5.98
152.01	0.51	41.795	36.258	-5.54	6.05
152.05	0.71	41.804	36.260	-5.54	6.25
152.09	1.07	41.817	36.263	-5.55	6.62
152.13	0.74	41.829	36.265	-5.56	6.30
152.19	1.23	41.845	36.269	-5.58	6.81
152.24	1.19	41.860	36.272	-5.59	6.78
152.30	0.52	41.877	36.276	-5.60	6.12
152.37	0.36	41.896	36.281	-5.62	5.98
152.44	1.23	41.916	36.285	-5.63	6.86
152.50	1.14	41.936	36.289	-5.65	6.79
152.55	0.66	41.949	36.292	-5.66	6.32
152.59	0.56	41.960	36.295	-5.67	6.23

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
152.71	1.05	41.995	36.303	-5.69	6.74
152.78	1.23	42.014	36.307	-5.71	6.94
152.83	1.70	42.030	36.311	-5.72	7.42
152.89	1.26	42.046	36.314	-5.73	6.99
152.95	1.41	42.063	36.318	-5.75	7.16
152.99	1.55	42.077	36.321	-5.76	7.31
153.03	1.50	42.088	36.323	-5.76	7.26
153.09	2.19	42.105	36.327	-5.78	7.97
153.15	2.64	42.121	36.331	-5.79	8.43
153.20	3.19	42.136	36.334	-5.80	8.99
153.29	2.95	42.163	36.340	-5.82	8.77
153.35	1.71	42.178	36.344	-5.83	7.54
153.39	0.41	42.192	36.347	-5.85	6.26
153.47	0.49	42.215	36.352	-5.86	6.35
153.52	0.26	42.229	36.355	-5.87	6.13
153.56	0.25	42.239	36.357	-5.88	6.13
153.70	0.40	42.279	36.366	-5.91	6.31
153.75	0.28	42.293	36.369	-5.92	6.20
153.80	0.56	42.308	36.373	-5.94	6.50
153.85	0.88	42.324	36.376	-5.95	6.83
153.91	0.45	42.341	36.380	-5.96	6.41
153.96	0.55	42.356	36.383	-5.97	6.52
154.01	0.71	42.370	36.386	-5.98	6.69
154.09	0.32	42.391	36.391	-6.00	6.32
154.14	0.67	42.407	36.395	-6.01	6.68
154.21	0.59	42.427	36.399	-6.03	6.62
154.25	0.00	42.438	36.402	-6.04	6.04
154.38	0.00	42.476	36.410	-6.07	6.07
154.43	0.59	42.489	36.413	-6.08	6.67

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
154.47	0.59	42.500	36.416	-6.08	6.67
154.59	0.00	42.535	36.423	-6.11	6.11
154.72	0.00	42.572	36.432	-6.14	6.14
154.80	0.01	42.595	36.437	-6.16	6.17
154.84	0.48	42.609	36.440	-6.17	6.65
154.91	0.26	42.627	36.444	-6.18	6.44
154.97	0.57	42.645	36.448	-6.20	6.77
155.04	0.52	42.665	36.452	-6.21	6.73
155.07	0.32	42.673	36.454	-6.22	6.54
155.12	0.35	42.687	36.457	-6.23	6.58
155.17	0.30	42.703	36.461	-6.24	6.54
155.24	0.26	42.722	36.465	-6.26	6.52
155.30	0.25	42.740	36.469	-6.27	6.52
155.37	0.00	42.761	36.474	-6.29	6.29
155.42	0.00	42.774	36.477	-6.30	6.30
155.44	0.00	42.780	36.478	-6.30	6.30
155.45	0.00	42.783	36.479	-6.30	6.30
155.49	0.00	42.795	36.481	-6.31	6.31
155.53	0.00	42.807	36.484	-6.32	6.32
155.55	0.00	42.811	36.485	-6.33	6.33
155.60	0.60	42.827	36.489	-6.34	6.94
155.63	0.49	42.835	36.490	-6.34	6.83
155.67	0.35	42.846	36.493	-6.35	6.70
155.71	0.26	42.858	36.495	-6.36	6.62
155.75	0.46	42.869	36.498	-6.37	6.83
155.77	0.35	42.874	36.499	-6.37	6.72
155.79	0.00	42.880	36.500	-6.38	6.38
155.81	0.00	42.887	36.502	-6.38	6.38
155.85	0.40	42.898	36.504	-6.39	6.79

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
155.89	0.56	42.909	36.507	-6.40	6.96
155.93	1.02	42.922	36.510	-6.41	7.43
155.97	0.60	42.931	36.512	-6.42	7.02
156.07	0.62	42.960	36.518	-6.44	7.06
156.18	0.60	42.992	36.525	-6.47	7.07
156.26	0.43	43.016	36.531	-6.49	6.92
156.31	0.75	43.030	36.534	-6.50	7.25
156.36	0.56	43.045	36.537	-6.51	7.07
156.40	0.49	43.056	36.540	-6.52	7.01
156.43	0.65	43.065	36.542	-6.52	7.17
156.49	0.32	43.082	36.545	-6.54	6.86
156.52	0.86	43.092	36.548	-6.54	7.40
156.56	0.76	43.101	36.550	-6.55	7.31
156.59	1.23	43.110	36.552	-6.56	7.79
156.62	1.90	43.120	36.554	-6.57	8.47
156.65	1.42	43.129	36.556	-6.57	7.99
156.75	1.89	43.157	36.562	-6.59	8.48
156.86	1.66	43.188	36.569	-6.62	8.28
156.96	3.04	43.217	36.576	-6.64	9.68
157.15	2.31	43.271	36.588	-6.68	8.99
157.16	2.29	43.275	36.589	-6.69	8.98
157.35	0.53	43.329	36.601	-6.73	7.26
157.36	0.36	43.333	36.602	-6.73	7.09
157.47	0.40	43.362	36.608	-6.75	7.15
157.58	0.32	43.396	36.616	-6.78	7.10
157.63	0.27	43.410	36.619	-6.79	7.06
157.67	0.37	43.421	36.621	-6.80	7.17
157.72	0.40	43.436	36.625	-6.81	7.21
157.77	0.27	43.450	36.628	-6.82	7.09

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
157.95	0.79	43.501	36.639	-6.86	7.65
157.98	0.72	43.510	36.641	-6.87	7.59
158.01	0.47	43.518	36.643	-6.88	7.35
158.02	0.46	43.523	38.394	-5.13	5.59
158.07	0.44	43.537	43.777	0.24	0.20
158.09	0.44	43.538	43.778	0.24	0.20
158.14	0.31	43.540	43.780	0.24	0.07
158.19	0.26	43.542	43.782	0.24	0.02
158.23	0.35	43.544	43.784	0.24	0.11
158.26	0.72	43.545	43.785	0.24	0.48
158.31	0.00	43.547	43.787	0.24	0.00
158.36	0.59	43.550	43.790	0.24	0.35
158.46	0.00	43.554	43.794	0.24	0.00
158.59	0.29	43.560	43.800	0.24	0.05
158.65	0.49	43.562	43.802	0.24	0.25
158.70	0.69	43.565	43.805	0.24	0.45
158.75	0.31	43.567	43.807	0.24	0.07
158.80	0.46	43.569	43.809	0.24	0.22
158.85	0.29	43.571	43.811	0.24	0.05
159.02	0.73	43.578	43.818	0.24	0.49
159.08	0.40	43.581	43.821	0.24	0.16
159.12	0.36	43.583	43.823	0.24	0.12
159.16	0.28	43.585	43.825	0.24	0.04
159.23	0.58	43.588	43.828	0.24	0.34
159.27	0.25	43.590	43.830	0.24	0.01
159.32	0.25	43.592	43.832	0.24	0.01
159.37	0.27	43.594	43.834	0.24	0.03
159.42	0.25	43.596	43.836	0.24	0.01
159.46	0.25	43.598	43.838	0.24	0.01

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
159.61	0.32	43.604	43.844	0.24	0.08
159.66	0.26	43.607	43.847	0.24	0.02
159.79	0.66	43.612	43.852	0.24	0.42
159.86	0.30	43.615	43.855	0.24	0.06
159.96	0.55	43.620	43.860	0.24	0.31
160.09	0.34	43.625	43.865	0.24	0.10
160.15	0.00	43.628	43.868	0.24	0.00
160.26	0.28	43.633	43.873	0.24	0.04
160.39	0.63	43.639	43.879	0.24	0.39
160.53	0.39	43.645	43.885	0.24	0.15
160.70	0.45	43.652	43.892	0.24	0.21
160.84	0.48	43.659	43.899	0.24	0.24
160.98	1.04	43.665	43.905	0.24	0.80
161.12	0.42	43.671	43.911	0.24	0.18
161.29	0.38	43.678	43.918	0.24	0.14
161.47	0.42	43.686	43.926	0.24	0.18
161.68	0.44	43.695	43.935	0.24	0.20
161.88	0.50	43.704	43.944	0.24	0.26
162.10	0.45	43.714	43.954	0.24	0.21
162.34	0.97	43.724	43.964	0.24	0.73
162.59	0.77	43.735	43.975	0.24	0.53
162.82	0.55	43.745	43.985	0.24	0.31
163.01	0.86	43.754	43.994	0.24	0.62
163.28	0.92	43.765	44.005	0.24	0.68
163.46	1.07	43.773	44.013	0.24	0.83
163.62	0.38	43.780	44.020	0.24	0.14
163.82	0.47	43.789	44.029	0.24	0.23
164.07	0.44	43.800	44.040	0.24	0.20
164.30	0.48	43.810	44.050	0.24	0.24

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
164.45	1.10	43.817	44.057	0.24	0.86
164.64	1.05	43.825	44.065	0.24	0.81
164.79	0.46	43.832	44.072	0.24	0.22
164.90	0.59	43.836	44.076	0.24	0.35
164.99	0.88	43.841	44.081	0.24	0.64
165.11	1.47	43.846	44.086	0.24	1.23
165.15	1.27	43.847	44.087	0.24	1.03
165.20	1.24	43.850	44.090	0.24	1.00
165.22	1.35	43.851	44.091	0.24	1.11
165.28	0.69	43.853	44.093	0.24	0.45
165.39	0.70	43.858	44.098	0.24	0.46
165.59	0.68	43.867	44.107	0.24	0.44
165.72	1.98	43.873	44.113	0.24	1.74
165.87	0.52	43.879	44.119	0.24	0.28
166.02	0.42	43.886	44.126	0.24	0.18
166.24	0.58	43.895	44.135	0.24	0.34
166.43	0.50	43.904	44.144	0.24	0.26
166.70	0.65	43.916	44.156	0.24	0.41
166.81	1.07	43.920	44.160	0.24	0.83
166.92	0.65	43.925	44.165	0.24	0.41
167.07	1.51	43.932	44.172	0.24	1.27
167.26	1.46	43.940	44.180	0.24	1.22
167.44	2.03	43.948	44.188	0.24	1.79
167.56	6.47	43.953	44.193	0.24	6.23
167.72	6.72	43.960	44.200	0.24	6.48
167.82	8.04	43.965	44.205	0.24	7.80
167.90	5.91	43.968	44.208	0.24	5.67
168.04	7.17	43.974	44.214	0.24	6.93
168.19	7.07	43.981	44.221	0.24	6.83

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
168.37	9.85	43.989	44.229	0.24	9.61
168.56	5.98	43.997	44.237	0.24	5.74
168.65	3.72	44.069	44.188	0.12	3.60
168.84	11.34	44.208	44.093	-0.12	11.46
169.02	15.64	44.338	44.004	-0.33	15.97
169.20	3.70	44.473	43.913	-0.56	4.26
169.33	6.22	44.569	43.847	-0.72	6.94
169.47	8.65	44.672	43.777	-0.89	9.54
169.62	8.40	44.780	43.959	-0.82	9.22
169.75	3.56	44.875	44.119	-0.76	4.32
169.85	0.80	44.952	44.248	-0.70	1.50
170.03	6.29	45.088	44.477	-0.61	6.90
170.13	3.09	45.157	44.592	-0.56	3.65
170.28	4.65	45.272	44.785	-0.49	5.14
170.48	3.04	45.418	45.032	-0.39	3.43
170.64	3.11	45.535	45.228	-0.31	3.42
170.80	0.44	45.650	45.422	-0.23	0.67
170.95	0.46	45.763	45.612	-0.15	0.61
171.05	0.48	45.835	45.732	-0.10	0.58
171.21	0.68	45.954	45.934	-0.02	0.70
171.24	0.45	45.975	45.969	-0.01	0.46
171.46	0.56	46.143	46.251	0.11	0.45
171.73	0.45	46.337	46.577	0.24	0.21
171.90	1.22	46.468	46.797	0.33	0.89
172.08	0.45	46.597	47.015	0.42	0.03
172.34	0.47	46.791	47.341	0.55	0.00
172.56	0.92	46.955	47.616	0.66	0.26
172.74	0.50	47.082	47.831	0.75	0.00
172.97	0.42	47.257	48.125	0.87	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
173.16	0.44	47.399	48.363	0.96	0.00
173.39	0.49	47.566	48.643	1.08	0.00
173.62	0.80	47.736	48.930	1.19	0.00
173.71	1.27	47.802	49.040	1.24	0.03
173.71	0.87	47.803	49.043	1.24	0.00
173.91	0.82	47.950	49.290	1.34	0.00
174.25	0.46	48.203	49.715	1.51	0.00
174.45	1.62	48.348	49.959	1.61	0.01
174.67	0.62	48.508	50.228	1.72	0.00
174.85	0.44	48.638	50.306	1.67	0.00
175.00	1.90	48.742	50.368	1.63	0.27
175.13	1.67	48.831	50.421	1.59	0.08
175.21	0.35	48.889	50.615	1.73	0.00
175.35	0.28	48.989	50.675	1.69	0.00
175.63	0.34	49.182	50.791	1.61	0.00
175.81	1.70	49.315	50.710	1.40	0.30
175.83	0.28	49.327	50.877	1.55	0.00
175.88	0.42	49.362	50.738	1.38	0.00
176.03	0.51	49.465	50.800	1.33	0.00
176.10	1.07	49.518	50.831	1.31	0.00
176.17	0.99	49.568	50.861	1.29	0.00
176.29	1.74	49.648	50.909	1.26	0.48
176.33	2.64	49.677	50.926	1.25	1.39
176.37	2.85	49.703	50.942	1.24	1.61
176.40	2.98	49.729	50.957	1.23	1.75
176.43	3.29	49.747	50.968	1.22	2.07
176.47	3.15	49.778	50.986	1.21	1.94
176.52	2.96	49.807	51.004	1.20	1.76
176.61	0.76	49.873	51.043	1.17	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
176.67	0.46	49.918	51.070	1.15	0.00
176.76	0.68	49.979	51.107	1.13	0.00
176.82	0.76	50.024	51.133	1.11	0.00
176.94	0.61	50.102	51.180	1.08	0.00
177.05	1.63	50.179	51.226	1.05	0.58
177.05	0.00	50.186	51.230	1.04	0.00
177.25	0.00	50.321	51.311	0.99	0.00
177.31	0.32	50.368	51.339	0.97	0.00
177.38	0.39	50.412	51.365	0.95	0.00
177.48	0.00	50.484	51.408	0.92	0.00
177.70	0.00	50.638	51.500	0.86	0.00
177.82	0.47	50.725	51.552	0.83	0.00
177.87	0.30	50.760	51.573	0.81	0.00
177.91	0.00	50.785	51.588	0.80	0.00
177.94	0.00	50.806	51.600	0.79	0.00
177.97	0.39	50.832	51.616	0.78	0.00
178.05	0.00	50.887	51.649	0.76	0.00
178.25	0.30	51.024	51.730	0.71	0.00
178.26	0.00	51.031	51.735	0.70	0.00
178.45	0.00	51.166	51.815	0.65	0.00
178.52	0.06	51.214	51.844	0.63	0.00
178.54	0.00	51.232	51.855	0.62	0.00
178.58	0.00	51.261	51.872	0.61	0.00
178.72	0.00	51.356	51.928	0.57	0.00
178.81	0.54	51.418	51.966	0.55	0.00
178.92	1.04	51.496	52.012	0.52	0.52
179.03	0.99	51.572	52.058	0.49	0.50
179.11	0.56	51.627	52.091	0.46	0.10
179.13	0.28	51.644	52.100	0.46	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
179.22	0.84	51.707	52.138	0.43	0.41
179.78	1.02	52.101	52.374	0.27	0.75
179.84	0.57	52.140	52.397	0.26	0.31
179.93	1.40	52.205	52.436	0.23	1.17
180.01	0.58	52.264	52.471	0.21	0.37
180.07	0.81	52.303	52.494	0.19	0.62
180.15	0.70	52.363	52.530	0.17	0.53
180.28	0.00	52.451	52.582	0.13	0.00
180.47	0.90	52.585	52.662	0.08	0.82
180.62	0.53	52.690	52.726	0.04	0.49
180.67	0.30	52.729	52.749	0.02	0.28
180.72	0.00	52.759	52.767	0.01	0.00
180.76	0.00	52.792	52.786	-0.01	0.01
180.91	0.86	52.892	52.846	-0.05	0.91
180.96	0.26	52.927	52.867	-0.06	0.32
181.00	0.00	52.961	52.887	-0.07	0.07
181.07	0.36	53.004	52.913	-0.09	0.45
181.17	0.41	53.080	52.958	-0.12	0.53
181.30	0.61	53.166	53.010	-0.16	0.77
181.36	0.28	53.213	53.037	-0.18	0.46
181.46	0.00	53.284	53.080	-0.20	0.20
181.49	0.00	53.300	53.089	-0.21	0.21
181.55	0.54	53.346	53.117	-0.23	0.77
181.62	0.02	53.393	53.145	-0.25	0.27
181.74	0.52	53.480	53.197	-0.28	0.80
181.76	0.42	53.490	53.203	-0.29	0.71
181.93	0.00	53.609	53.274	-0.34	0.34
181.97	0.00	53.643	53.294	-0.35	0.35
182.04	0.29	53.690	53.322	-0.37	0.66

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
182.08	0.21	53.718	53.339	-0.38	0.59
182.34	0.42	53.899	53.447	-0.45	0.87
182.40	0.25	53.939	53.471	-0.47	0.72
182.45	0.34	53.979	53.495	-0.48	0.82
182.61	0.00	54.088	53.560	-0.53	0.53
182.64	0.00	54.108	53.572	-0.54	0.54
182.66	0.00	54.122	53.580	-0.54	0.54
183.16	0.02	54.478	53.793	-0.68	0.70
183.19	0.44	54.499	53.805	-0.69	1.13
183.25	0.36	54.537	53.828	-0.71	1.07
183.31	0.36	54.582	53.855	-0.73	1.09
183.33	0.00	54.595	53.863	-0.73	0.73
183.34	0.00	54.602	53.867	-0.74	0.74
183.34	0.00	54.605	53.868	-0.74	0.74
183.37	0.00	54.622	53.879	-0.74	0.74
183.40	0.00	54.643	53.892	-0.75	0.75
183.45	0.00	54.681	53.914	-0.77	0.77
183.60	0.34	54.784	53.976	-0.81	1.15
183.66	0.00	54.825	54.000	-0.82	0.82
183.81	0.00	54.936	54.066	-0.87	0.87
183.87	0.00	54.972	54.088	-0.88	0.88
184.03	0.00	55.090	54.158	-0.93	0.93
184.07	0.00	55.118	54.175	-0.94	0.94
184.22	0.00	55.220	54.236	-0.98	0.98
184.25	0.00	55.245	54.251	-0.99	0.99
184.27	0.25	55.258	54.259	-1.00	1.25
184.28	0.00	55.262	54.261	-1.00	1.00
184.29	0.00	55.268	54.264	-1.00	1.00
184.30	0.00	55.277	54.270	-1.01	1.01

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
184.32	0.00	55.292	54.279	-1.01	1.01
184.34	0.00	55.302	54.285	-1.02	1.02
184.34	0.00	55.309	54.289	-1.02	1.02
184.37	0.00	55.325	54.299	-1.03	1.03
184.98	0.14	55.753	54.555	-1.20	1.34
185.03	0.00	55.790	54.576	-1.21	1.21
185.07	0.30	55.815	54.591	-1.22	1.52
185.10	0.05	55.841	54.607	-1.23	1.28
185.12	0.00	55.856	54.616	-1.24	1.24
185.14	0.00	55.870	54.624	-1.25	1.25
185.17	0.00	55.887	54.634	-1.25	1.25
185.27	0.49	55.960	54.678	-1.28	1.77
185.38	0.25	56.037	54.724	-1.31	1.56
185.47	0.40	56.099	54.761	-1.34	1.74
185.57	0.72	56.170	54.803	-1.37	2.09
185.70	1.08	56.259	54.857	-1.40	2.48
185.82	1.60	56.345	54.908	-1.44	3.04
185.93	1.89	56.420	54.952	-1.47	3.36
186.06	1.66	56.510	55.006	-1.50	3.16
186.18	2.61	56.596	55.058	-1.54	4.15
186.30	2.06	56.684	55.110	-1.57	3.63
186.43	2.75	56.771	55.162	-1.61	4.36
186.54	1.63	56.854	55.212	-1.64	3.27
186.67	1.92	56.939	55.262	-1.68	3.60
186.78	1.01	57.022	55.312	-1.71	2.72
186.90	0.52	57.104	55.361	-1.74	2.26
186.96	0.00	57.143	55.384	-1.76	1.76
187.14	0.32	57.275	55.463	-1.81	2.13
187.25	0.00	57.351	55.509	-1.84	1.84

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
187.33	0.69	57.405	55.541	-1.86	2.55
187.37	2.61	57.436	55.559	-1.88	4.49
187.46	1.41	57.499	55.597	-1.90	3.31
187.58	0.57	57.583	55.647	-1.94	2.51
187.65	1.41	57.632	55.676	-1.96	3.37
187.78	0.30	57.720	55.729	-1.99	2.29
187.86	0.90	57.779	55.764	-2.01	2.91
187.98	0.68	57.860	55.813	-2.05	2.73
188.01	0.40	57.885	55.827	-2.06	2.46
188.06	0.00	57.917	55.847	-2.07	2.07
188.16	0.57	57.990	55.890	-2.10	2.67
188.21	0.51	58.025	55.911	-2.11	2.62
188.26	0.48	58.060	55.932	-2.13	2.61
188.31	0.94	58.097	55.954	-2.14	3.08
188.37	0.85	58.135	55.977	-2.16	3.01
188.42	1.67	58.173	55.999	-2.17	3.84
188.46	1.07	58.202	56.017	-2.19	3.26
188.50	0.69	58.230	56.033	-2.20	2.89
188.54	0.35	58.257	56.049	-2.21	2.56
188.56	0.31	58.273	56.059	-2.21	2.52
188.65	0.42	58.335	56.096	-2.24	2.66
188.70	0.00	58.371	56.118	-2.25	2.25
188.75	0.00	58.406	56.138	-2.27	2.27
188.84	0.46	58.468	56.176	-2.29	2.75
188.92	0.58	58.525	56.210	-2.32	2.90
188.99	1.79	58.574	56.239	-2.34	4.13
189.05	0.64	58.613	56.262	-2.35	2.99
189.08	0.69	58.634	56.275	-2.36	3.05
189.13	0.27	58.674	56.298	-2.38	2.65

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
189.19	0.00	58.710	56.320	-2.39	2.39
189.23	0.00	58.740	56.338	-2.40	2.40
189.30	0.14	58.791	56.369	-2.42	2.56
189.35	0.54	58.827	56.390	-2.44	2.98
189.41	0.99	58.869	56.415	-2.45	3.44
189.48	0.74	58.916	56.443	-2.47	3.21
189.63	0.99	59.024	56.508	-2.52	3.51
189.65	0.27	59.035	56.514	-2.52	2.79
189.70	0.00	59.069	56.535	-2.53	2.53
189.71	0.00	59.076	56.538	-2.54	2.54
189.73	0.00	59.096	56.550	-2.55	2.55
189.76	0.33	59.111	56.559	-2.55	2.88
189.87	0.46	59.193	56.608	-2.58	3.04
189.93	0.36	59.230	56.630	-2.60	2.96
189.96	0.00	59.254	56.645	-2.61	2.61
190.07	0.68	59.333	56.692	-2.64	3.32
190.18	1.15	59.411	56.739	-2.67	3.82
190.23	0.24	59.445	56.759	-2.69	2.93
190.32	0.00	59.506	56.795	-2.71	2.71
190.37	0.64	59.541	56.816	-2.72	3.36
190.41	0.87	59.570	56.834	-2.74	3.61
190.48	0.44	59.616	56.861	-2.76	3.20
190.51	0.34	59.640	56.875	-2.76	3.10
190.55	0.01	59.672	56.895	-2.78	2.79
190.60	0.48	59.705	56.914	-2.79	3.27
190.62	0.80	59.716	56.921	-2.80	3.60
190.65	0.58	59.740	56.935	-2.80	3.38
190.75	1.21	59.812	56.978	-2.83	4.04
190.86	0.89	59.884	57.021	-2.86	3.75

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
190.97	0.37	59.962	57.068	-2.89	3.26
191.10	0.38	60.054	57.123	-2.93	3.31
191.13	0.00	60.077	57.136	-2.94	2.94
191.18	0.45	60.113	57.158	-2.96	3.41
191.31	1.15	60.206	58.460	-1.75	2.90
191.36	0.74	60.236	58.886	-1.35	2.09
191.40	1.04	60.255	58.906	-1.35	2.39
191.46	0.04	60.276	58.929	-1.35	1.39
191.53	1.04	60.306	58.961	-1.35	2.39
191.60	0.41	60.334	58.990	-1.34	1.75
191.66	0.40	60.362	59.020	-1.34	1.74
191.72	0.49	60.387	59.047	-1.34	1.83
191.81	0.48	60.421	59.083	-1.34	1.82
191.87	0.43	60.447	59.110	-1.34	1.77
191.93	0.11	60.471	59.135	-1.34	1.45
191.99	0.50	60.498	59.164	-1.33	1.83
192.06	0.48	60.526	59.194	-1.33	1.81
192.14	0.37	60.558	59.228	-1.33	1.70
192.20	0.57	60.585	59.256	-1.33	1.90
192.26	0.33	60.608	59.281	-1.33	1.66
192.27	0.45	60.610	59.283	-1.33	1.78
192.62	0.00	60.756	59.438	-1.32	1.32
192.66	0.00	60.771	59.454	-1.32	1.32
192.75	0.26	60.810	59.496	-1.31	1.57
192.86	0.00	60.856	59.545	-1.31	1.31
192.95	0.00	60.894	59.584	-1.31	1.31
193.06	0.00	60.935	59.629	-1.31	1.31
193.15	0.00	60.975	59.671	-1.30	1.30
193.19	0.00	60.990	59.686	-1.30	1.30

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
193.26	0.28	61.018	59.716	-1.30	1.58
193.32	0.00	61.043	59.744	-1.30	1.30
193.39	0.00	61.072	59.774	-1.30	1.30
193.45	0.46	61.100	59.803	-1.30	1.76
193.52	0.51	61.128	59.833	-1.29	1.80
193.59	0.44	61.155	59.862	-1.29	1.73
193.65	0.88	61.181	59.890	-1.29	2.17
193.72	0.36	61.209	59.920	-1.29	1.65
193.78	0.34	61.234	59.946	-1.29	1.63
193.85	0.76	61.263	59.977	-1.29	2.05
193.93	0.51	61.296	60.011	-1.28	1.79
193.99	0.00	61.320	60.037	-1.28	1.28
194.04	0.31	61.341	60.060	-1.28	1.59
194.08	0.00	61.355	60.075	-1.28	1.28
194.18	0.00	61.399	60.122	-1.28	1.28
194.22	0.00	61.413	60.136	-1.28	1.28
194.26	0.71	61.430	60.154	-1.28	1.99
194.35	0.50	61.469	60.195	-1.27	1.77
194.48	0.83	61.520	60.250	-1.27	2.10
194.52	0.65	61.536	60.267	-1.27	1.92
194.57	1.41	61.559	60.291	-1.27	2.68
194.65	1.22	61.594	60.328	-1.27	2.49
194.83	1.80	61.667	60.406	-1.26	3.06
194.88	2.16	61.685	60.425	-1.26	3.42
195.01	1.36	61.740	60.484	-1.26	2.62
195.06	2.28	61.759	60.504	-1.26	3.54
195.16	2.40	61.803	60.550	-1.25	3.65
195.28	2.85	61.852	60.603	-1.25	4.10
195.44	2.85	61.919	60.673	-1.25	4.10

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
195.48	2.54	61.935	60.691	-1.24	3.78
195.64	1.34	62.000	60.760	-1.24	2.58
195.69	1.25	62.020	60.781	-1.24	2.49
195.83	1.12	62.078	60.843	-1.24	2.36
195.88	1.17	62.100	60.866	-1.23	2.40
196.04	1.33	62.162	60.932	-1.23	2.56
196.05	1.30	62.168	60.938	-1.23	2.53
196.16	0.92	62.214	60.987	-1.23	2.15
196.34	0.96	62.289	61.066	-1.22	2.18
196.39	1.42	62.307	61.086	-1.22	2.64
196.46	1.08	62.337	61.117	-1.22	2.30
196.53	0.76	62.368	61.150	-1.22	1.98
196.60	0.62	62.395	61.180	-1.22	1.84
196.66	0.25	62.420	61.206	-1.21	1.46
196.74	0.25	62.454	61.242	-1.21	1.46
196.84	0.25	62.492	61.282	-1.21	1.46
196.89	0.29	62.515	61.306	-1.21	1.50
196.94	0.00	62.536	61.329	-1.21	1.21
196.98	0.32	62.553	61.347	-1.21	1.53
197.02	0.34	62.567	61.362	-1.21	1.55
197.06	0.71	62.584	61.379	-1.20	1.91
197.12	0.91	62.609	61.406	-1.20	2.11
197.18	0.96	62.631	61.430	-1.20	2.16
197.23	1.17	62.655	61.455	-1.20	2.37
197.29	1.19	62.679	61.481	-1.20	2.39
197.35	0.97	62.702	61.506	-1.20	2.17
197.40	0.85	62.725	61.530	-1.20	2.05
197.46	1.23	62.748	61.554	-1.19	2.42
197.48	1.43	62.758	61.565	-1.19	2.62

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
197.62	1.31	62.815	61.626	-1.19	2.50
197.67	0.32	62.835	61.647	-1.19	1.51
197.71	0.00	62.853	61.665	-1.19	1.19
197.78	0.00	62.882	61.696	-1.19	1.19
197.85	0.00	62.911	61.727	-1.18	1.18
197.91	0.31	62.935	61.752	-1.18	1.49
197.95	0.00	62.950	61.769	-1.18	1.18
198.00	0.37	62.973	61.793	-1.18	1.55
198.06	0.27	62.996	61.818	-1.18	1.45
198.11	0.00	63.018	61.841	-1.18	1.18
198.18	0.68	63.046	61.871	-1.18	1.86
198.26	0.60	63.079	61.906	-1.17	1.77
198.28	0.09	63.088	61.915	-1.17	1.26
198.34	0.33	63.112	61.941	-1.17	1.50
198.39	0.00	63.132	61.962	-1.17	1.17
198.45	0.00	63.156	61.987	-1.17	1.17
198.51	0.42	63.182	62.015	-1.17	1.59
198.56	0.45	63.200	62.034	-1.17	1.62
198.59	0.00	63.215	62.051	-1.16	1.16
198.64	0.00	63.234	62.070	-1.16	1.16
198.68	0.27	63.252	62.090	-1.16	1.43
198.82	0.00	63.307	62.148	-1.16	1.16
198.89	0.00	63.340	62.182	-1.16	1.16
198.95	0.26	63.362	62.207	-1.16	1.42
199.04	0.48	63.400	62.247	-1.15	1.63
199.13	0.50	63.438	62.287	-1.15	1.65
199.33	0.00	63.518	62.372	-1.15	1.15
199.33	0.00	63.519	62.373	-1.15	1.15
199.34	0.00	63.522	62.376	-1.15	1.15

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
199.35	0.00	63.526	62.381	-1.15	1.15
199.36	0.37	63.530	62.385	-1.15	1.52
199.43	0.67	63.562	62.418	-1.14	1.81
199.48	1.31	63.579	62.437	-1.14	2.45
199.65	0.00	63.650	62.513	-1.14	1.14
199.66	0.00	63.654	62.516	-1.14	1.14
199.85	2.02	63.732	62.599	-1.13	3.15
199.88	0.00	63.745	62.613	-1.13	1.13
200.05	0.16	63.814	62.686	-1.13	1.29
200.05	1.07	63.816	62.689	-1.13	2.20
200.24	0.87	63.895	62.772	-1.12	1.99
200.26	1.31	63.901	62.779	-1.12	2.43
200.45	0.67	63.979	62.861	-1.12	1.79
200.50	0.00	63.999	62.883	-1.12	1.12
200.60	1.30	64.042	62.929	-1.11	2.41
200.67	1.22	64.070	62.958	-1.11	2.33
200.76	0.34	64.107	62.997	-1.11	1.45
200.90	0.34	64.164	63.058	-1.11	1.45
200.96	0.46	64.188	63.084	-1.10	1.56
201.02	0.34	64.216	63.113	-1.10	1.44
201.05	0.28	64.228	63.126	-1.10	1.38
201.23	0.30	64.301	63.204	-1.10	1.40
201.27	0.67	64.318	63.222	-1.10	1.77
201.39	0.00	64.367	63.274	-1.09	1.09
201.48	0.00	64.402	63.311	-1.09	1.09
201.52	0.00	64.420	63.330	-1.09	1.09
201.57	0.32	64.440	63.351	-1.09	1.41
201.61	0.43	64.457	63.370	-1.09	1.52
201.65	0.26	64.474	63.388	-1.09	1.35

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
201.68	0.40	64.485	63.399	-1.09	1.49
201.70	0.27	64.494	63.409	-1.09	1.36
201.73	0.40	64.508	63.423	-1.08	1.48
201.75	0.26	64.516	63.432	-1.08	1.34
201.82	0.67	64.546	63.464	-1.08	1.75
201.94	1.07	64.591	63.512	-1.08	2.15
202.05	1.52	64.637	63.560	-1.08	2.60
202.12	0.53	64.669	63.594	-1.07	1.60
202.23	0.85	64.712	63.640	-1.07	1.92
202.34	0.84	64.759	63.690	-1.07	1.91
202.45	1.45	64.805	63.739	-1.07	2.52
202.57	1.42	64.854	63.791	-1.06	2.48
202.70	1.20	64.905	63.845	-1.06	2.26
202.82	1.73	64.955	63.899	-1.06	2.79
202.94	0.99	65.005	63.951	-1.05	2.04
202.99	1.35	65.026	63.974	-1.05	2.40
203.03	0.61	65.041	63.990	-1.05	1.66
203.06	0.51	65.054	64.004	-1.05	1.56
203.17	2.25	65.100	64.052	-1.05	3.30
203.29	0.33	65.150	64.105	-1.04	1.37
203.35	0.25	65.176	64.133	-1.04	1.29
203.42	1.14	65.203	64.162	-1.04	2.18
203.47	0.85	65.224	64.184	-1.04	1.89
203.53	0.50	65.247	64.209	-1.04	1.54
203.58	0.00	65.268	64.231	-1.04	1.04
203.64	0.82	65.294	64.258	-1.04	1.86
203.71	1.12	65.322	64.288	-1.03	2.15
203.73	0.00	65.330	64.296	-1.03	1.03
203.79	0.47	65.354	64.323	-1.03	1.50

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
204.08	0.37	65.473	64.448	-1.02	1.39
204.41	0.42	65.611	64.595	-1.02	1.44
204.75	0.49	65.749	64.742	-1.01	1.50
204.97	0.49	65.843	64.842	-1.00	1.49
205.14	0.55	65.910	64.913	-1.00	1.55
205.28	0.82	65.967	64.974	-0.99	1.81
205.47	1.88	66.045	65.056	-0.99	2.87
205.72	0.44	66.149	65.167	-0.98	1.42
205.95	0.34	66.246	65.269	-0.98	1.32
206.17	0.95	66.335	65.364	-0.97	1.92
206.37	0.53	66.417	65.452	-0.97	1.50
206.63	0.46	66.523	65.564	-0.96	1.42
206.91	0.49	66.639	65.687	-0.95	1.44
206.99	0.43	66.674	65.724	-0.95	1.38
207.21	0.44	66.761	65.817	-0.94	1.38
207.47	0.41	66.872	65.934	-0.94	1.35
207.67	0.59	66.951	66.018	-0.93	1.52
207.85	0.44	67.026	66.098	-0.93	1.37
208.13	0.55	67.143	66.222	-0.92	1.47
208.46	0.53	67.277	66.365	-0.91	1.44
208.76	0.53	67.400	66.495	-0.90	1.43
208.98	0.57	67.493	66.594	-0.90	1.47
209.24	0.72	67.599	66.707	-0.89	1.61
209.58	0.59	67.740	66.856	-0.88	1.47
209.74	0.34	67.807	66.927	-0.88	1.22
209.81	0.63	67.833	66.955	-0.88	1.51
209.97	0.58	67.898	67.024	-0.87	1.45
210.23	0.57	68.008	67.141	-0.87	1.44
210.48	1.06	68.111	67.251	-0.86	1.92

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
210.70	0.48	68.200	67.344	-0.86	1.34
211.00	0.52	68.322	67.475	-0.85	1.37
211.20	1.45	68.407	67.565	-0.84	2.29
211.36	0.96	68.472	67.634	-0.84	1.80
211.44	0.00	68.505	67.669	-0.84	0.84
211.52	0.35	68.539	67.705	-0.83	1.18
211.69	0.44	68.607	67.777	-0.83	1.27
211.84	0.38	68.671	67.846	-0.83	1.21
212.00	0.40	68.735	67.914	-0.82	1.22
212.19	0.90	68.813	67.997	-0.82	1.72
212.34	1.28	68.874	68.061	-0.81	2.09
212.58	0.50	68.974	68.167	-0.81	1.31
212.85	0.48	69.086	68.286	-0.80	1.28
212.99	0.27	69.134	68.288	-0.85	1.12
213.07	0.53	69.161	68.289	-0.87	1.40
213.24	0.39	69.219	68.291	-0.93	1.32
213.46	0.40	69.291	68.293	-1.00	1.40
213.70	0.87	69.372	68.296	-1.08	1.95
213.94	0.49	69.455	68.299	-1.16	1.65
214.22	0.35	69.550	68.302	-1.25	1.60
214.45	0.61	69.628	68.305	-1.32	1.93
214.71	0.63	69.716	68.308	-1.41	2.04
214.95	0.46	69.796	68.311	-1.49	1.95
215.15	0.93	69.865	68.313	-1.55	2.48
215.30	0.48	69.914	68.315	-1.60	2.08
215.40	1.45	69.949	68.316	-1.63	3.08
215.53	1.48	69.994	68.318	-1.68	3.16
215.69	2.27	70.048	68.320	-1.73	4.00
215.85	0.70	70.101	68.321	-1.78	2.48

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
216.04	0.43	70.164	68.324	-1.84	2.27
216.06	0.00	70.171	68.324	-1.85	1.85
216.11	0.43	70.189	68.325	-1.86	2.29
216.20	1.06	70.221	68.326	-1.90	2.96
216.22	1.06	70.225	68.326	-1.90	2.96
216.26	1.10	70.239	68.326	-1.91	3.01
216.29	1.05	70.252	68.327	-1.92	2.97
216.38	1.09	70.279	68.328	-1.95	3.04
216.39	0.00	70.284	68.328	-1.96	1.96
216.43	0.49	70.298	68.328	-1.97	2.46
216.54	1.13	70.334	68.330	-2.00	3.13
216.58	0.00	70.349	68.330	-2.02	2.02
216.66	0.50	70.374	68.331	-2.04	2.54
216.86	1.56	70.442	68.333	-2.11	3.67
216.98	0.00	70.485	68.335	-2.15	2.15
217.06	0.62	70.510	68.336	-2.17	2.79
217.14	0.46	70.537	68.337	-2.20	2.66
217.26	0.62	70.578	68.338	-2.24	2.86
217.42	0.47	70.633	68.340	-2.29	2.76
217.58	0.50	70.688	68.342	-2.35	2.85
217.70	0.73	70.729	68.343	-2.39	3.12
217.90	0.40	70.794	68.346	-2.45	2.85
218.12	1.16	70.870	68.348	-2.52	3.68
218.32	0.00	70.938	68.351	-2.59	2.59
218.41	0.80	70.967	68.352	-2.62	3.42
218.49	1.05	70.996	68.353	-2.64	3.69
218.70	0.94	71.065	68.355	-2.71	3.65
218.86	1.73	71.120	68.357	-2.76	4.49
218.99	0.88	71.165	68.359	-2.81	3.69

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
219.09	1.29	71.199	68.360	-2.84	4.13
219.23	2.41	71.246	68.362	-2.88	5.29
219.36	0.64	71.291	68.363	-2.93	3.57
219.52	0.69	71.342	68.525	-2.82	3.51
219.63	0.39	71.382	68.366	-3.02	3.41
219.75	0.41	71.421	68.368	-3.05	3.46
219.96	0.65	71.494	68.370	-3.12	3.77
220.16	1.83	71.561	68.373	-3.19	5.02
220.36	1.30	71.629	68.375	-3.25	4.55
220.51	0.68	71.680	68.377	-3.30	3.98
220.70	1.26	71.744	68.379	-3.36	4.62
220.85	0.95	71.793	68.381	-3.41	4.36
220.98	1.23	71.838	68.382	-3.46	4.69
221.20	0.71	71.911	68.385	-3.53	4.24
221.36	2.01	71.966	68.387	-3.58	5.59
221.55	1.03	72.031	68.389	-3.64	4.67
221.76	0.51	72.102	68.391	-3.71	4.22
221.95	1.13	72.166	68.394	-3.77	4.90
221.96	0.60	72.170	68.394	-3.78	4.38
222.15	0.38	72.233	68.396	-3.84	4.22
222.20	0.50	72.250	68.397	-3.85	4.35
222.31	0.43	72.289	68.398	-3.89	4.32
222.37	0.27	72.307	68.399	-3.91	4.18
222.43	0.00	72.328	68.399	-3.93	3.93
222.49	0.00	72.348	68.400	-3.95	3.95
222.51	0.25	72.356	68.400	-3.96	4.21
222.52	0.00	72.359	68.400	-3.96	3.96
222.63	0.00	72.395	68.402	-3.99	3.99
222.67	0.33	72.410	68.402	-4.01	4.34

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
222.79	0.36	72.451	68.404	-4.05	4.41
222.85	0.71	72.470	68.404	-4.07	4.78
222.91	0.45	72.490	68.405	-4.09	4.54
222.96	0.00	72.509	68.406	-4.10	4.10
223.04	0.81	72.533	68.407	-4.13	4.94
223.11	0.53	72.559	68.407	-4.15	4.68
223.18	0.79	72.581	68.408	-4.17	4.96
223.22	0.31	72.596	68.409	-4.19	4.50
223.28	0.62	72.617	68.409	-4.21	4.83
223.34	0.01	72.636	68.410	-4.23	4.24
223.40	0.00	72.658	68.411	-4.25	4.25
223.44	0.00	72.672	68.411	-4.26	4.26
223.49	0.12	72.687	68.412	-4.27	4.39
223.53	0.00	72.702	68.412	-4.29	4.29
223.59	0.34	72.721	68.413	-4.31	4.65
223.64	0.31	72.739	68.414	-4.33	4.64
223.70	0.43	72.757	68.414	-4.34	4.77
223.74	0.28	72.773	68.415	-4.36	4.64
223.79	0.49	72.788	68.415	-4.37	4.86
223.94	0.93	72.840	68.417	-4.42	5.35
223.95	1.10	72.844	68.417	-4.43	5.53
224.14	0.00	72.907	68.420	-4.49	4.49
224.19	0.43	72.924	68.420	-4.50	4.93
224.34	0.00	72.975	68.422	-4.55	4.55
224.36	0.00	72.983	68.422	-4.56	4.56
224.51	0.25	73.032	68.424	-4.61	4.86
224.56	0.58	73.048	68.425	-4.62	5.20
224.62	0.45	73.069	68.425	-4.64	5.09
224.67	0.37	73.086	68.426	-4.66	5.03

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
224.73	0.46	73.108	68.427	-4.68	5.14
224.79	0.42	73.127	68.427	-4.70	5.12
224.83	0.34	73.142	68.428	-4.71	5.05
224.90	0.00	73.164	68.429	-4.74	4.74
224.95	0.31	73.180	68.429	-4.75	5.06
224.98	0.00	73.190	68.429	-4.76	4.76
225.01	0.31	73.202	68.430	-4.77	5.08
225.03	0.00	73.208	68.430	-4.78	4.78
225.04	0.00	73.213	68.430	-4.78	4.78
225.06	0.33	73.217	68.430	-4.79	5.12
225.07	0.35	73.221	68.431	-4.79	5.14
225.11	0.55	73.234	68.431	-4.80	5.35
225.16	0.36	73.252	68.432	-4.82	5.18
225.23	0.54	73.277	68.433	-4.84	5.38
225.29	0.44	73.298	68.433	-4.86	5.30
225.34	0.37	73.313	68.434	-4.88	5.25
225.39	0.30	73.331	68.434	-4.90	5.20
225.45	0.45	73.351	68.435	-4.92	5.37
225.49	0.00	73.365	68.436	-4.93	4.93
225.59	0.99	73.398	68.437	-4.96	5.95
225.64	1.16	73.414	68.437	-4.98	6.14
225.68	1.28	73.429	68.438	-4.99	6.27
225.73	1.28	73.444	68.438	-5.01	6.29
225.78	1.17	73.461	68.439	-5.02	6.19
225.82	0.76	73.476	68.439	-5.04	5.80
225.86	0.00	73.491	68.440	-5.05	5.05
225.91	0.47	73.506	68.441	-5.07	5.54
225.95	0.26	73.521	68.441	-5.08	5.34
226.00	0.00	73.537	68.442	-5.10	5.10

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
226.04	0.41	73.551	68.442	-5.11	5.52
226.08	0.64	73.564	68.443	-5.12	5.76
226.14	0.44	73.584	68.443	-5.14	5.58
226.19	0.60	73.603	68.444	-5.16	5.76
226.26	0.87	73.623	68.445	-5.18	6.05
226.32	1.16	73.645	68.445	-5.20	6.36
226.35	0.40	73.655	68.446	-5.21	5.61
226.35	0.45	73.656	68.446	-5.21	5.66
226.37	0.46	73.662	68.446	-5.22	5.68
226.55	0.54	73.723	69.818	-3.90	4.44
226.72	0.61	73.780	71.123	-2.66	3.27
226.89	0.57	73.839	72.459	-1.38	1.95
227.06	0.49	73.897	73.674	-0.22	0.71
227.16	0.00	74.000	73.627	-0.37	0.37
227.31	1.64	74.153	73.796	-0.36	2.00
227.39	0.81	74.228	73.879	-0.35	1.16
227.54	2.31	74.382	74.049	-0.33	2.64
227.55	0.00	74.395	74.063	-0.33	0.33
227.73	0.30	74.575	74.262	-0.31	0.61
227.76	0.26	74.605	74.295	-0.31	0.57
227.95	0.33	74.803	74.513	-0.29	0.62
227.96	0.60	74.813	74.524	-0.29	0.89
228.14	0.65	74.994	74.724	-0.27	0.92
228.20	0.85	75.055	74.791	-0.26	1.11
228.26	0.47	75.121	74.864	-0.26	0.73
228.44	0.47	75.303	75.065	-0.24	0.71
228.51	0.33	75.375	75.145	-0.23	0.56
228.65	9.37	75.514	75.299	-0.22	9.59
228.69	4.15	75.555	75.343	-0.21	4.36

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
228.73	7.29	75.597	75.389	-0.21	7.50
228.84	8.45	75.716	75.521	-0.20	8.65
228.86	10.67	75.728	75.535	-0.19	10.86
229.05	2.33	75.923	75.749	-0.17	2.50
229.08	2.87	75.961	75.792	-0.17	3.04
229.21	1.12	76.095	75.939	-0.16	1.28
229.26	1.24	76.139	75.988	-0.15	1.39
229.44	0.77	76.327	76.195	-0.13	0.90
229.47	0.67	76.362	76.234	-0.13	0.80
229.62	0.69	76.505	76.392	-0.11	0.80
229.67	1.09	76.558	76.450	-0.11	1.20
229.83	1.16	76.730	76.640	-0.09	1.25
229.86	1.70	76.752	76.665	-0.09	1.79
229.99	2.62	76.884	76.810	-0.07	2.69
230.09	1.20	76.986	76.923	-0.06	1.26
230.22	1.89	77.123	77.073	-0.05	1.94
230.27	1.53	77.170	77.126	-0.04	1.57
230.41	2.51	77.322	77.294	-0.03	2.54
230.45	2.25	77.360	77.336	-0.02	2.27
230.64	2.21	77.554	77.550	0.00	2.21
230.68	2.92	77.597	77.596	0.00	2.92
230.83	2.29	77.748	77.763	0.02	2.27
230.86	3.05	77.777	77.795	0.02	3.03
231.02	3.92	77.937	77.972	0.04	3.88
231.05	3.55	77.975	78.014	0.04	3.51
231.24	3.59	78.162	78.220	0.06	3.53
231.28	2.83	78.204	78.267	0.06	2.77
231.32	2.44	78.252	78.319	0.07	2.37
231.36	2.63	78.291	78.363	0.07	2.56

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
231.41	2.32	78.336	78.413	0.08	2.24
231.46	1.81	78.393	78.475	0.08	1.73
231.62	0.82	78.554	78.653	0.10	0.72
231.67	0.60	78.607	78.711	0.10	0.50
231.85	0.97	78.789	78.913	0.12	0.85
231.89	1.22	78.835	78.963	0.13	1.09
231.94	1.25	78.886	79.019	0.13	1.12
232.00	0.95	78.941	79.081	0.14	0.81
232.06	2.29	79.006	79.152	0.15	2.14
232.12	1.06	79.061	79.212	0.15	0.91
232.16	1.21	79.111	79.267	0.16	1.05
232.35	1.95	79.297	79.473	0.18	1.77
232.37	1.79	79.321	79.499	0.18	1.61
232.54	0.38	79.491	79.687	0.20	0.18
232.56	1.06	79.510	79.709	0.20	0.86
232.73	0.41	79.684	79.900	0.22	0.19
232.76	0.97	79.725	79.945	0.22	0.75
232.93	1.00	79.897	80.135	0.24	0.76
232.99	1.60	79.950	80.194	0.24	1.36
233.14	1.86	80.106	80.366	0.26	1.60
233.18	0.87	80.152	80.416	0.26	0.61
233.21	1.17	80.176	80.443	0.27	0.90
233.26	1.59	80.226	80.498	0.27	1.32
233.31	0.76	80.281	80.558	0.28	0.48
233.37	0.73	80.340	80.624	0.28	0.45
233.43	0.62	80.399	80.690	0.29	0.33
233.47	0.89	80.447	80.742	0.30	0.59
233.53	1.03	80.505	80.806	0.30	0.73
233.57	0.95	80.546	80.851	0.31	0.64

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
233.61	1.20	80.592	80.903	0.31	0.89
233.65	0.99	80.633	80.947	0.31	0.68
233.70	0.91	80.682	81.001	0.32	0.59
233.73	0.39	80.715	81.037	0.32	0.07
233.75	0.31	80.737	81.062	0.33	0.00
233.93	0.00	80.917	81.261	0.34	0.00
234.15	0.64	81.139	81.506	0.37	0.27
234.43	0.34	81.431	81.828	0.40	0.00
234.62	0.39	81.620	82.037	0.42	0.00
234.88	5.02	81.887	82.331	0.44	4.58
234.97	0.79	81.979	82.432	0.45	0.34
235.10	8.89	82.114	82.582	0.47	8.42
235.28	5.74	82.298	82.785	0.49	5.25
235.50	2.50	82.518	83.027	0.51	1.99
235.86	0.85	82.889	83.437	0.55	0.30
236.01	15.16	83.044	83.609	0.56	14.60
236.17	4.05	83.208	83.789	0.58	3.47
236.38	5.55	83.419	84.022	0.60	4.95
236.59	2.01	83.637	84.263	0.63	1.38
236.92	0.93	83.969	84.629	0.66	0.27
237.23	2.92	84.336	84.944	0.61	2.31
237.43	1.33	84.576	85.150	0.57	0.76
237.71	0.51	84.910	85.438	0.53	0.00
237.98	0.69	85.222	85.706	0.48	0.21
238.20	3.60	85.491	85.937	0.45	3.15
238.32	3.12	85.634	86.059	0.43	2.69
238.49	3.60	85.824	86.223	0.40	3.20
238.75	0.43	86.143	86.497	0.35	0.08
239.12	0.51	86.572	86.866	0.29	0.22

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
239.28	0.36	86.760	87.028	0.27	0.09
239.39	0.45	86.895	87.144	0.25	0.20
239.42	0.57	86.926	87.170	0.24	0.33
239.42	0.48	86.930	87.173	0.24	0.24
239.56	0.94	87.102	87.321	0.22	0.72
239.66	1.20	87.218	87.421	0.20	1.00
239.85	3.07	87.444	87.615	0.17	2.90
240.04	2.95	87.661	87.802	0.14	2.81
240.21	3.19	87.863	87.975	0.11	3.08
240.42	2.07	88.117	88.193	0.08	1.99
240.60	1.71	88.331	88.378	0.05	1.66
240.77	0.33	88.528	88.547	0.02	0.31
240.90	0.93	88.686	88.682	0.00	0.93
241.17	0.33	89.005	88.956	-0.05	0.38
241.27	0.00	89.119	89.054	-0.06	0.06
241.36	0.33	89.231	89.151	-0.08	0.41
241.37	0.37	89.236	89.155	-0.08	0.45
241.54	0.49	89.437	89.327	-0.11	0.60
241.60	0.46	89.507	89.388	-0.12	0.58
241.65	1.71	89.572	89.444	-0.13	1.84
241.84	0.37	89.790	89.631	-0.16	0.53
241.86	0.57	89.822	89.659	-0.16	0.73
242.04	0.60	90.032	89.839	-0.19	0.79
242.20	0.90	90.225	90.005	-0.22	1.12
242.40	0.99	90.456	90.204	-0.25	1.24
242.59	1.44	90.681	90.397	-0.28	1.72
242.81	1.43	90.935	90.615	-0.32	1.75
243.00	0.71	91.169	90.816	-0.35	1.06
243.12	1.02	91.310	90.938	-0.37	1.39

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
243.20	0.49	91.399	91.014	-0.39	0.88
243.49	1.46	91.742	91.308	-0.43	1.89
243.64	2.12	91.918	91.460	-0.46	2.58
243.81	2.86	92.126	91.639	-0.49	3.35
243.91	2.02	92.238	91.735	-0.50	2.52
244.06	2.10	92.425	91.896	-0.53	2.63
244.22	2.52	92.613	92.057	-0.56	3.08
244.29	0.87	92.694	92.127	-0.57	1.44
244.42	0.80	92.848	92.259	-0.59	1.39
244.61	0.54	93.075	92.454	-0.62	1.16
244.76	0.41	93.248	92.603	-0.65	1.06
244.77	0.42	93.255	92.608	-0.65	1.07
244.86	0.79	93.372	92.709	-0.66	1.45
245.10	2.10	93.647	92.945	-0.70	2.80
245.30	3.12	93.884	93.149	-0.73	3.85
245.46	2.61	94.077	93.315	-0.76	3.37
245.61	6.53	94.254	93.467	-0.79	7.32
245.76	3.78	94.435	93.623	-0.81	4.59
245.91	4.43	94.612	93.775	-0.84	5.27
246.07	6.06	94.796	93.933	-0.86	6.92
246.27	3.34	95.034	94.138	-0.90	4.24
246.44	2.84	95.235	94.311	-0.92	3.76
246.63	2.87	95.464	94.507	-0.96	3.83
246.75	2.27	95.605	94.629	-0.98	3.25
246.86	0.94	95.734	94.739	-1.00	1.94
247.06	1.01	95.966	94.938	-1.03	2.04
247.27	1.46	96.224	95.160	-1.06	2.52
247.54	1.14	96.539	95.431	-1.11	2.25
247.75	0.59	96.783	95.641	-1.14	1.73

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
247.83	1.19	96.879	95.723	-1.16	2.35
248.00	0.75	97.085	95.900	-1.18	1.93
248.21	0.67	97.334	96.114	-1.22	1.89
248.31	0.73	97.427	96.208	-1.22	1.95
248.53	1.24	97.638	96.421	-1.22	2.46
248.73	1.16	97.826	96.610	-1.22	2.38
248.95	0.41	98.035	96.821	-1.21	1.62
248.96	0.66	98.051	96.838	-1.21	1.87
248.98	0.81	98.064	96.850	-1.21	2.02
248.98	1.05	98.071	96.858	-1.21	2.26
248.99	0.43	98.080	96.866	-1.21	1.64
249.02	0.00	98.104	96.891	-1.21	1.21
249.04	0.00	98.122	96.908	-1.21	1.21
249.04	0.00	98.126	96.912	-1.21	1.21
249.04	0.00	98.129	96.916	-1.21	1.21
249.06	0.68	98.140	96.927	-1.21	1.89
249.17	1.76	98.245	97.033	-1.21	2.97
249.24	0.58	98.314	97.102	-1.21	1.79
249.28	0.46	98.353	97.141	-1.21	1.67
249.31	1.21	98.380	97.169	-1.21	2.42
249.34	0.58	98.411	97.200	-1.21	1.79
249.38	1.98	98.448	97.238	-1.21	3.19
249.43	1.78	98.501	97.291	-1.21	2.99
249.48	0.68	98.550	97.341	-1.21	1.89
249.52	1.96	98.589	97.380	-1.21	3.17
249.57	3.00	98.633	97.424	-1.21	4.21
249.61	4.53	98.669	97.460	-1.21	5.74
249.66	1.72	98.715	97.506	-1.21	2.93
249.72	0.73	98.780	97.573	-1.21	1.94

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
249.75	2.65	98.803	97.596	-1.21	3.86
249.77	3.31	98.826	97.619	-1.21	4.52
249.80	3.82	98.849	97.642	-1.21	5.03
249.82	4.61	98.875	97.669	-1.21	5.82
249.87	5.17	98.918	97.712	-1.21	6.38
249.89	3.42	98.940	97.734	-1.21	4.63
249.94	2.95	98.988	97.782	-1.21	4.16
250.02	0.73	99.065	97.860	-1.21	1.94
250.10	0.00	99.143	97.938	-1.20	1.20
250.16	0.29	99.200	97.996	-1.20	1.49
250.20	1.66	99.236	98.033	-1.20	2.86
250.25	2.04	99.288	98.084	-1.20	3.24
250.30	5.30	99.333	98.130	-1.20	6.50
250.34	3.77	99.370	98.168	-1.20	4.97
250.43	0.30	99.459	98.257	-1.20	1.50
250.45	1.48	99.471	98.270	-1.20	2.68
250.46	1.60	99.485	98.284	-1.20	2.80
250.46	1.81	99.486	98.284	-1.20	3.01
250.46	1.95	99.486	98.284	-1.20	3.15
250.46	1.70	99.486	98.285	-1.20	2.90
250.47	1.54	99.490	98.288	-1.20	2.74
250.49	2.39	99.512	98.311	-1.20	3.59
250.53	0.00	99.556	98.355	-1.20	1.20
250.57	0.00	99.588	98.387	-1.20	1.20
250.63	0.64	99.647	98.447	-1.20	1.84
250.69	0.28	99.709	98.509	-1.20	1.48
250.76	1.04	99.776	98.577	-1.20	2.24
250.81	0.00	99.822	98.623	-1.20	1.20
250.86	0.00	99.866	98.668	-1.20	1.20

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
250.96	0.58	99.959	98.761	-1.20	1.78
251.07	1.07	100.064	98.867	-1.20	2.27
251.25	1.42	100.239	99.044	-1.20	2.62
251.28	2.14	100.270	99.075	-1.19	3.33
251.43	1.04	100.412	99.219	-1.19	2.23
251.46	0.65	100.440	99.247	-1.19	1.84
251.64	1.93	100.618	99.426	-1.19	3.12
251.69	0.72	100.663	99.471	-1.19	1.91
251.83	1.27	100.800	99.610	-1.19	2.46
251.87	2.62	100.830	99.639	-1.19	3.81
251.99	0.22	100.950	99.760	-1.19	1.41
252.14	2.02	101.089	99.901	-1.19	3.21
252.18	1.68	101.134	99.946	-1.19	2.87
252.23	0.38	101.183	99.996	-1.19	1.57
252.27	0.38	101.214	100.027	-1.19	1.57
252.41	1.15	101.354	100.169	-1.19	2.34
252.53	2.09	101.463	100.278	-1.18	3.27
252.79	1.36	101.712	100.529	-1.18	2.54
252.94	2.29	101.857	100.676	-1.18	3.47
253.15	2.50	102.056	100.877	-1.18	3.68
253.30	1.24	102.200	101.022	-1.18	2.42
253.41	1.56	102.309	101.131	-1.18	2.74
253.54	2.71	102.428	101.252	-1.18	3.89
253.71	1.87	102.593	101.418	-1.18	3.05
253.89	1.54	102.764	101.590	-1.17	2.71
254.08	1.17	102.953	101.781	-1.17	2.34
254.32	0.90	103.182	102.012	-1.17	2.07
254.52	2.23	103.371	102.203	-1.17	3.40
254.60	2.50	103.446	102.278	-1.17	3.67

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
254.66	2.84	103.501	102.333	-1.17	4.01
254.95	2.70	103.783	102.618	-1.16	3.86
255.25	0.94	104.070	102.908	-1.16	2.10
255.51	1.23	104.318	103.157	-1.16	2.39
255.63	1.30	104.429	103.270	-1.16	2.46
255.79	0.96	104.582	103.423	-1.16	2.12
255.96	5.99	104.745	103.589	-1.16	7.15
256.16	2.36	104.937	103.782	-1.16	3.52
256.35	1.07	105.121	103.967	-1.15	2.22
256.47	0.45	105.239	104.087	-1.15	1.60
256.61	0.75	105.374	104.222	-1.15	1.90
256.74	1.01	105.500	104.350	-1.15	2.16
256.97	2.99	105.716	104.567	-1.15	4.14
257.20	3.47	105.931	104.785	-1.15	4.62
257.37	3.01	106.094	104.949	-1.15	4.16
257.53	1.13	106.253	105.109	-1.14	2.27
257.81	0.45	106.523	105.381	-1.14	1.59
257.86	0.66	106.567	105.425	-1.14	1.80
258.05	0.71	106.748	105.609	-1.14	1.85
258.11	0.60	106.811	105.672	-1.14	1.74
258.37	0.46	107.053	105.916	-1.14	1.60
258.50	0.55	107.185	106.049	-1.14	1.69
258.58	0.53	107.256	106.121	-1.14	1.67
258.65	0.45	107.321	106.187	-1.13	1.58
258.76	0.43	107.433	106.299	-1.13	1.56
258.78	0.53	107.452	106.318	-1.13	1.66
258.93	0.47	107.593	106.460	-1.13	1.60
259.01	0.49	107.665	106.534	-1.13	1.62
259.15	0.79	107.800	106.670	-1.13	1.92

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
259.26	0.43	107.907	106.778	-1.13	1.56
259.45	0.42	108.087	106.959	-1.13	1.55
259.50	0.49	108.137	107.009	-1.13	1.62
259.66	2.52	108.294	107.168	-1.13	3.65
259.95	1.94	108.570	107.446	-1.12	3.06
260.19	2.82	108.797	107.675	-1.12	3.94
260.45	0.85	109.045	107.925	-1.12	1.97
260.73	1.26	109.315	108.197	-1.12	2.38
260.75	0.69	109.333	108.215	-1.12	1.81
260.76	0.47	109.342	108.225	-1.12	1.59
260.86	1.71	109.444	108.327	-1.12	2.83
261.04	3.51	109.614	108.499	-1.12	4.63
261.21	2.48	109.771	108.657	-1.11	3.59
261.30	1.66	109.860	108.747	-1.11	2.77
261.50	1.36	110.052	108.941	-1.11	2.47
261.64	3.28	110.189	109.079	-1.11	4.39
261.73	2.98	110.268	109.158	-1.11	4.09
261.90	1.81	110.431	109.323	-1.11	2.92
262.05	2.70	110.577	109.470	-1.11	3.81
262.27	0.79	110.790	109.685	-1.11	1.90
262.49	0.83	111.003	109.899	-1.10	1.93
262.63	1.14	111.137	110.035	-1.10	2.24
262.81	0.55	111.301	110.201	-1.10	1.65
262.94	0.90	111.433	110.334	-1.10	2.00
263.19	0.61	111.670	110.572	-1.10	1.71
263.38	0.78	111.855	110.759	-1.10	1.88
263.50	0.36	111.966	110.871	-1.10	1.46
263.57	1.21	112.032	110.937	-1.09	2.30
263.75	1.62	112.207	111.114	-1.09	2.71

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
263.88	1.23	112.331	111.239	-1.09	2.32
264.06	1.64	112.498	111.407	-1.09	2.73
264.28	1.82	112.715	111.626	-1.09	2.91
264.35	1.37	112.780	111.692	-1.09	2.46
264.58	2.97	112.997	111.911	-1.09	4.06
264.66	2.75	113.076	111.990	-1.09	3.84
264.82	1.75	113.229	112.145	-1.08	2.83
265.01	2.04	113.410	112.327	-1.08	3.12
265.25	2.89	113.639	112.559	-1.08	3.97
265.42	1.67	113.802	112.723	-1.08	2.75
265.58	1.06	113.955	112.876	-1.08	2.14
265.76	0.74	114.133	113.056	-1.08	1.82
265.94	0.70	114.302	113.227	-1.08	1.78
266.13	0.75	114.484	113.411	-1.07	1.82
266.33	1.05	114.670	113.598	-1.07	2.12
266.43	1.62	114.774	113.853	-0.92	2.54
266.58	0.63	114.912	113.842	-1.07	1.70
266.79	1.17	114.929	113.884	-1.05	2.22
267.04	1.38	114.949	113.932	-1.02	2.40
267.22	0.81	114.963	113.966	-1.00	1.81
267.44	1.28	114.980	114.008	-0.97	2.25
267.51	0.61	114.986	114.022	-0.96	1.57
267.64	2.80	114.996	114.048	-0.95	3.75
267.84	0.64	115.012	114.087	-0.93	1.57
267.98	1.19	115.023	114.114	-0.91	2.10
268.20	0.68	115.041	114.157	-0.88	1.56
268.45	1.43	115.060	114.205	-0.86	2.29
268.65	1.90	115.076	114.244	-0.83	2.73
268.81	2.16	115.089	114.274	-0.82	2.98

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
268.90	1.21	115.096	114.292	-0.80	2.01
269.17	1.93	115.118	114.345	-0.77	2.70
269.42	0.78	115.137	114.392	-0.75	1.53
269.68	1.59	115.158	114.443	-0.71	2.30
270.07	1.81	115.189	114.518	-0.67	2.48
270.27	2.50	115.205	114.558	-0.65	3.15
270.37	0.57	115.213	114.577	-0.64	1.21
270.56	2.54	115.228	114.614	-0.61	3.15
270.78	2.33	115.245	114.656	-0.59	2.92
271.09	1.15	115.270	114.716	-0.55	1.70
271.22	0.94	115.280	114.741	-0.54	1.48
271.44	1.25	115.297	114.783	-0.51	1.76
271.63	1.91	115.313	114.821	-0.49	2.40
271.83	1.76	115.329	114.860	-0.47	2.23
271.98	2.61	115.341	114.889	-0.45	3.06
272.17	1.73	115.355	114.925	-0.43	2.16
272.42	0.40	115.376	114.975	-0.40	0.80
272.60	0.54	115.390	115.009	-0.38	0.92
272.78	0.45	115.404	115.044	-0.36	0.81
272.80	0.75	115.406	115.048	-0.36	1.11
272.84	0.37	115.409	115.056	-0.35	0.72
272.86	2.32	115.411	115.060	-0.35	2.67
272.92	0.91	115.415	115.072	-0.34	1.25
272.93	0.91	115.416	115.072	-0.34	1.25
272.97	0.69	115.419	115.081	-0.34	1.03
273.09	2.85	115.428	115.104	-0.32	3.17
273.31	2.60	115.446	115.145	-0.30	2.90
273.46	3.46	115.458	115.175	-0.28	3.74
273.52	1.40	115.463	115.187	-0.28	1.68

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
273.68	2.04	115.476	115.219	-0.26	2.30
273.82	1.44	115.486	115.244	-0.24	1.68
273.89	1.69	115.492	115.259	-0.23	1.92
273.99	2.40	115.500	115.278	-0.22	2.62
274.20	3.25	115.517	115.320	-0.20	3.45
274.44	1.95	115.535	115.365	-0.17	2.12
274.63	1.03	115.551	115.402	-0.15	1.18
274.70	0.99	115.556	115.415	-0.14	1.13
274.82	1.23	115.566	115.439	-0.13	1.36
275.03	1.53	115.582	115.479	-0.10	1.63
275.25	1.59	115.600	115.523	-0.08	1.67
275.44	1.70	115.615	115.558	-0.06	1.76
275.59	2.75	115.627	115.588	-0.04	2.79
275.80	2.96	115.643	115.628	-0.02	2.98
275.95	0.44	115.655	115.657	0.00	0.44
276.11	2.70	115.668	115.689	0.02	2.68
276.20	0.67	115.675	115.707	0.03	0.64
276.40	0.51	115.691	115.745	0.05	0.46
276.65	0.59	115.711	115.794	0.08	0.51
276.86	0.37	115.727	115.833	0.11	0.26
277.05	3.64	115.743	115.871	0.13	3.51
277.25	1.14	115.759	115.910	0.15	0.99
277.55	0.65	115.782	115.968	0.19	0.46
277.63	0.40	115.788	115.983	0.19	0.21
277.70	0.63	115.794	115.997	0.20	0.43
277.85	2.03	115.806	116.026	0.22	1.81
277.95	2.50	115.814	116.045	0.23	2.27
278.08	3.06	115.824	116.070	0.25	2.81
278.23	2.16	115.836	116.099	0.26	1.90

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
278.36	2.22	115.847	116.126	0.28	1.94
278.49	3.31	115.857	116.150	0.29	3.02
278.64	3.18	115.868	116.178	0.31	2.87
278.78	3.25	115.880	116.207	0.33	2.92
278.94	1.72	115.892	116.237	0.34	1.38
279.07	1.30	115.903	116.263	0.36	0.94
279.30	0.41	116.217	116.525	0.31	0.10
279.44	0.24	116.409	116.846	0.44	0.00
279.51	3.58	116.496	116.759	0.26	3.32
279.51	2.34	116.499	116.761	0.26	2.08
279.55	3.70	116.552	116.806	0.25	3.45
279.70	3.93	116.750	116.971	0.22	3.71
279.82	2.01	116.925	117.118	0.19	1.82
279.91	1.42	117.046	117.218	0.17	1.25
280.14	1.73	117.358	117.479	0.12	1.61
280.29	2.98	117.554	117.643	0.09	2.89
280.49	2.59	117.831	117.874	0.04	2.55
280.58	0.84	117.947	117.971	0.02	0.82
280.77	2.85	118.214	118.194	-0.02	2.87
280.92	0.79	118.409	118.357	-0.05	0.84
280.96	0.89	118.462	118.402	-0.06	0.95
281.00	1.17	118.529	118.458	-0.07	1.24
281.08	1.75	118.626	118.539	-0.09	1.84
281.27	1.87	118.894	118.762	-0.13	2.00
281.46	2.17	119.154	118.980	-0.17	2.34
281.66	0.38	119.424	119.206	-0.22	0.60
281.79	0.61	119.602	119.355	-0.25	0.86
281.85	1.19	119.682	119.421	-0.26	1.45
282.02	1.20	119.906	119.608	-0.30	1.50

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
282.21	0.78	120.175	119.833	-0.34	1.12
282.42	1.09	120.458	120.070	-0.39	1.48
282.62	1.03	120.724	120.292	-0.43	1.46
282.79	3.50	120.962	120.491	-0.47	3.97
282.93	2.13	121.140	120.640	-0.50	2.63
283.14	2.88	121.428	120.880	-0.55	3.43
283.27	1.47	121.615	121.037	-0.58	2.05
283.47	2.23	121.879	121.258	-0.62	2.85
283.67	1.81	122.150	121.484	-0.67	2.48
283.88	1.94	122.433	121.721	-0.71	2.65
284.10	1.80	122.744	121.980	-0.76	2.56
284.27	2.76	122.973	122.172	-0.80	3.56
284.42	1.69	123.174	122.340	-0.83	2.52
284.54	3.25	123.339	122.478	-0.86	4.11
284.56	3.59	123.366	122.501	-0.87	4.46
284.56	1.54	123.367	122.501	-0.87	2.41
284.58	1.32	123.392	122.522	-0.87	2.19
284.65	1.54	123.480	122.595	-0.88	2.42
284.75	2.19	123.624	122.716	-0.91	3.10
284.84	3.21	123.740	122.813	-0.93	4.14
284.88	3.32	123.793	122.857	-0.94	4.26
285.03	0.57	124.007	123.036	-0.97	1.54
285.27	2.15	124.324	123.301	-1.02	3.17
285.49	0.67	124.630	123.557	-1.07	1.74
285.65	0.60	124.845	123.737	-1.11	1.71
285.88	1.19	125.154	123.995	-1.16	2.35
286.11	0.91	125.472	124.261	-1.21	2.12
286.19	1.53	125.576	124.348	-1.23	2.76
286.41	1.95	125.878	124.600	-1.28	3.23

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
286.62	0.74	126.163	124.838	-1.33	2.07
286.80	0.52	126.413	125.047	-1.37	1.89
287.12	0.46	126.836	125.401	-1.44	1.90
287.16	1.64	126.895	125.450	-1.45	3.09
287.21	3.20	126.970	125.512	-1.46	4.66
287.24	3.00	127.009	125.545	-1.46	4.46
287.40	2.24	127.220	125.721	-1.50	3.74
287.72	1.88	127.663	126.091	-1.57	3.45
288.06	3.17	128.115	126.469	-1.65	4.82
288.27	3.12	128.409	126.715	-1.69	4.81
288.48	2.84	128.690	126.950	-1.74	4.58
288.72	1.65	129.016	127.223	-1.79	3.44
289.10	1.61	129.530	127.652	-1.88	3.49
289.39	0.83	129.925	127.982	-1.94	2.77
289.80	0.49	130.484	128.449	-2.03	2.52
289.96	0.00	130.708	128.637	-2.07	2.07
290.12	1.18	130.922	128.815	-2.11	3.29
290.18	1.41	130.996	128.877	-2.12	3.53
290.33	0.50	131.208	129.054	-2.15	2.65
290.35	1.43	131.239	129.080	-2.16	3.59
290.55	0.63	131.503	129.301	-2.20	2.83
290.59	0.56	131.558	129.347	-2.21	2.77
290.66	1.69	131.654	129.427	-2.23	3.92
290.85	1.45	131.917	129.647	-2.27	3.72
290.94	0.84	132.000	129.743	-2.26	3.10
290.96	1.38	132.027	129.774	-2.25	3.63
290.99	0.99	132.051	129.801	-2.25	3.24
291.04	1.55	132.106	129.864	-2.24	3.79
291.07	0.67	132.138	129.901	-2.24	2.91

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
291.16	1.22	132.230	130.007	-2.22	3.44
291.24	1.48	132.303	130.091	-2.21	3.69
291.31	1.10	132.381	130.180	-2.20	3.30
291.38	1.52	132.446	130.255	-2.19	3.71
291.45	1.40	132.512	130.331	-2.18	3.58
291.51	0.91	132.578	130.407	-2.17	3.08
291.53	1.35	132.597	130.429	-2.17	3.52
291.55	1.44	132.616	130.451	-2.17	3.61
291.57	0.46	132.634	130.472	-2.16	2.62
291.58	1.19	132.651	130.491	-2.16	3.35
291.63	0.29	132.695	130.542	-2.15	2.44
291.67	1.67	132.742	130.595	-2.15	3.82
291.72	1.36	132.783	130.643	-2.14	3.50
291.76	1.31	132.827	130.693	-2.13	3.44
291.82	1.25	132.890	130.765	-2.12	3.37
291.88	1.43	132.944	130.828	-2.12	3.55
291.92	0.63	132.985	130.875	-2.11	2.74
292.00	1.01	133.071	130.974	-2.10	3.11
292.09	0.44	133.160	131.076	-2.08	2.52
292.13	0.56	133.203	131.126	-2.08	2.64
292.16	0.29	133.227	131.153	-2.07	2.36
292.24	0.72	133.305	131.243	-2.06	2.78
292.29	0.70	133.364	131.311	-2.05	2.75
292.36	1.22	133.434	131.391	-2.04	3.26
292.40	1.10	133.471	131.433	-2.04	3.14
292.43	1.26	133.503	131.470	-2.03	3.29
292.46	1.37	133.529	131.501	-2.03	3.40
292.48	1.29	133.553	131.528	-2.02	3.31
292.51	0.30	133.578	131.557	-2.02	2.32

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
292.51	0.45	133.582	131.561	-2.02	2.47
292.52	0.51	133.592	131.573	-2.02	2.53
292.56	0.66	133.627	131.614	-2.01	2.67
292.59	0.30	133.660	131.651	-2.01	2.31
292.62	0.48	133.688	131.684	-2.00	2.48
292.66	0.46	133.727	131.728	-2.00	2.46
292.84	0.00	133.907	131.935	-1.97	1.97
292.88	0.00	133.953	131.988	-1.96	1.96
292.93	0.00	134.001	132.044	-1.96	1.96
292.98	0.00	134.057	132.107	-1.95	1.95
293.04	0.00	134.112	132.171	-1.94	1.94
293.08	0.00	134.153	132.218	-1.93	1.93
293.20	0.00	134.268	132.350	-1.92	1.92
293.24	0.00	134.317	132.407	-1.91	1.91
293.29	0.00	134.363	132.459	-1.90	1.90
293.37	0.00	134.448	132.557	-1.89	1.89
293.46	0.00	134.538	132.661	-1.88	1.88
293.56	0.00	134.637	132.775	-1.86	1.86
293.67	0.00	134.743	132.897	-1.85	1.85
293.75	0.00	134.827	132.993	-1.83	1.83
293.95	0.00	135.023	133.218	-1.80	1.80
293.96	1.92	135.038	133.235	-1.80	3.72
294.14	3.45	135.216	133.440	-1.78	5.23
294.19	1.91	135.270	133.502	-1.77	3.68
294.25	1.52	135.328	133.569	-1.76	3.28
294.44	2.07	135.517	133.786	-1.73	3.80
294.49	1.85	135.564	133.840	-1.72	3.57
294.62	2.94	135.698	133.995	-1.70	4.64
294.68	2.27	135.754	134.059	-1.70	3.97

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
294.83	1.45	135.906	134.234	-1.67	3.12
294.86	1.37	135.940	134.272	-1.67	3.04
295.05	1.54	136.124	134.485	-1.64	3.18
295.07	1.90	136.153	134.517	-1.64	3.54
295.19	0.87	136.267	134.649	-1.62	2.49
295.26	0.36	136.344	134.737	-1.61	1.97
295.38	2.03	136.461	134.872	-1.59	3.62
295.46	0.53	136.544	134.967	-1.58	2.11
295.52	0.40	136.601	135.033	-1.57	1.97
295.58	0.41	136.659	135.099	-1.56	1.97
295.69	0.29	136.768	135.225	-1.54	1.83
295.80	0.74	136.876	135.350	-1.53	2.27
295.85	0.92	136.935	135.418	-1.52	2.44
295.96	0.67	137.044	135.543	-1.50	2.17
296.02	0.58	137.104	135.611	-1.49	2.07
296.10	0.61	137.179	135.698	-1.48	2.09
296.16	1.01	137.240	135.768	-1.47	2.48
296.23	1.01	137.308	135.846	-1.46	2.47
296.30	1.02	137.379	135.928	-1.45	2.47
296.36	0.26	137.443	136.001	-1.44	1.70
296.42	0.95	137.508	136.076	-1.43	2.38
296.48	0.53	137.568	136.145	-1.42	1.95
296.57	1.29	137.655	136.245	-1.41	2.70
296.64	0.35	137.729	136.330	-1.40	1.75
296.70	0.46	137.789	136.399	-1.39	1.85
296.78	1.11	137.862	136.483	-1.38	2.49
296.86	1.15	137.947	136.580	-1.37	2.52
296.95	0.46	138.036	136.683	-1.35	1.81
297.03	0.28	138.113	136.772	-1.34	1.62

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
297.13	0.46	138.214	136.888	-1.33	1.79
297.22	0.26	138.305	136.993	-1.31	1.57
297.32	0.55	138.402	137.103	-1.30	1.85
297.39	0.36	138.480	137.194	-1.29	1.65
297.44	0.48	138.527	137.248	-1.28	1.76
297.53	0.47	138.622	137.357	-1.27	1.74
297.58	0.25	138.666	137.408	-1.26	1.51
297.66	0.25	138.753	137.507	-1.25	1.50
297.79	0.33	138.879	137.653	-1.23	1.56
297.91	0.72	138.995	137.786	-1.21	1.93
297.98	0.94	139.070	137.872	-1.20	2.14
298.09	0.25	139.174	137.992	-1.18	1.43
298.22	0.90	139.312	138.151	-1.16	2.06
298.26	0.62	139.351	138.195	-1.16	1.78
298.42	0.79	139.508	138.376	-1.13	1.92
298.48	1.10	139.567	138.444	-1.12	2.22
298.64	1.21	139.733	138.635	-1.10	2.31
298.66	1.50	139.749	138.653	-1.10	2.60
298.82	1.27	139.916	138.845	-1.07	2.34
298.88	1.03	139.975	138.913	-1.06	2.09
299.04	0.96	140.136	139.098	-1.04	2.00
299.08	1.07	140.169	139.135	-1.03	2.10
299.22	0.66	140.317	139.306	-1.01	1.67
299.26	0.86	140.357	139.352	-1.01	1.87
299.33	0.30	140.422	139.426	-1.00	1.30
299.43	0.35	140.520	139.539	-0.98	1.33
299.48	0.31	140.576	139.604	-0.97	1.28
299.56	0.26	140.649	139.688	-0.96	1.22
299.66	0.51	140.749	139.803	-0.95	1.46

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
299.75	0.25	140.847	139.915	-0.93	1.18
299.84	0.25	140.936	140.018	-0.92	1.17
299.94	0.57	141.035	140.131	-0.90	1.47
300.03	0.34	141.125	140.235	-0.89	1.23
300.09	0.31	141.185	140.304	-0.88	1.19
300.16	0.75	141.260	140.390	-0.87	1.62
300.24	0.94	141.333	140.474	-0.86	1.80
300.31	0.96	141.402	140.553	-0.85	1.81
300.38	0.70	141.472	140.634	-0.84	1.54
300.44	0.36	141.533	140.704	-0.83	1.19
300.49	0.53	141.591	140.771	-0.82	1.35
300.56	1.23	141.656	140.846	-0.81	2.04
300.62	1.28	141.722	140.922	-0.80	2.08
300.68	0.55	141.775	140.983	-0.79	1.34
300.73	0.68	141.823	141.038	-0.79	1.47
300.79	0.32	141.884	141.108	-0.78	1.10
300.80	0.29	141.898	141.123	-0.77	1.06
300.87	1.84	141.967	141.203	-0.76	2.60
300.92	1.25	142.021	141.265	-0.76	2.01
300.98	0.99	142.078	141.331	-0.75	1.74
301.04	1.38	142.138	141.400	-0.74	2.12
301.10	1.18	142.196	141.467	-0.73	1.91
301.15	1.22	142.253	141.532	-0.72	1.94
301.21	1.31	142.309	141.596	-0.71	2.02
301.26	0.98	142.364	141.660	-0.70	1.68
301.31	1.36	142.414	141.717	-0.70	2.06
301.32	0.39	142.422	141.727	-0.70	1.09
301.32	0.48	142.424	141.728	-0.70	1.18
301.32	0.46	142.424	141.728	-0.70	1.16

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
301.32	0.58	142.424	141.728	-0.70	1.28
301.37	0.70	142.468	141.779	-0.69	1.39
301.40	0.69	142.498	141.814	-0.68	1.37
301.43	1.08	142.526	141.846	-0.68	1.76
301.45	0.70	142.554	141.878	-0.68	1.38
301.48	0.70	142.585	141.913	-0.67	1.37
301.56	0.00	142.656	141.996	-0.66	0.66
301.72	1.88	142.825	142.190	-0.64	2.52
301.76	1.96	142.859	142.229	-0.63	2.59
301.80	1.87	142.901	142.277	-0.62	2.49
301.85	1.60	142.952	142.336	-0.62	2.22
301.88	1.54	142.986	142.375	-0.61	2.15
301.93	0.33	143.035	142.431	-0.60	0.93
301.98	0.65	143.087	142.491	-0.60	1.25
302.05	0.98	143.148	142.561	-0.59	1.57
302.11	1.24	143.212	142.635	-0.58	1.82
302.14	1.63	143.247	142.674	-0.57	2.20
302.20	1.20	143.303	142.739	-0.56	1.76
302.25	1.37	143.353	142.797	-0.56	1.93
302.42	0.78	143.527	142.997	-0.53	1.31
302.51	1.17	143.611	143.094	-0.52	1.69
302.60	0.64	143.700	143.196	-0.50	1.14
302.69	0.75	143.793	143.303	-0.49	1.24
302.74	1.08	143.840	143.357	-0.48	1.56
302.79	1.28	143.893	143.418	-0.48	1.76
302.84	1.67	143.949	143.482	-0.47	2.14
302.89	1.34	143.999	143.539	-0.46	1.80
302.94	1.35	144.048	143.596	-0.45	1.80
302.99	2.08	144.097	143.652	-0.44	2.52

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
303.04	2.21	144.145	143.708	-0.44	2.65
303.06	2.47	144.169	143.735	-0.43	2.90
303.07	2.49	144.178	143.745	-0.43	2.92
303.11	2.70	144.211	143.784	-0.43	3.13
303.15	3.05	144.255	143.834	-0.42	3.47
303.20	3.87	144.302	143.888	-0.41	4.28
303.24	3.59	144.341	143.933	-0.41	4.00
303.28	3.18	144.384	143.982	-0.40	3.58
303.32	3.41	144.423	144.028	-0.40	3.81
303.36	2.67	144.467	144.077	-0.39	3.06
303.41	2.40	144.513	144.130	-0.38	2.78
303.45	2.18	144.556	144.180	-0.38	2.56
303.50	2.19	144.604	144.235	-0.37	2.56
303.65	3.60	144.754	144.408	-0.35	3.95
303.69	4.14	144.795	144.455	-0.34	4.48
303.84	0.25	144.950	144.633	-0.32	0.57
303.89	0.83	144.997	144.687	-0.31	1.14
303.95	1.24	145.061	144.761	-0.30	1.54
304.03	1.13	145.140	144.852	-0.29	1.42
304.09	0.97	145.198	144.918	-0.28	1.25
304.14	1.76	145.245	144.972	-0.27	2.03
304.18	1.56	145.292	145.026	-0.27	1.83
304.23	1.43	145.341	145.083	-0.26	1.69
304.29	0.72	145.401	145.152	-0.25	0.97
304.35	0.61	145.460	145.219	-0.24	0.85
304.43	1.11	145.538	145.310	-0.23	1.34
304.47	0.60	145.582	145.360	-0.22	0.82
304.50	0.65	145.608	145.389	-0.22	0.87
304.53	0.76	145.637	145.424	-0.21	0.97

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
304.56	0.65	145.674	145.466	-0.21	0.86
304.62	0.83	145.729	145.529	-0.20	1.03
304.67	1.32	145.780	145.587	-0.19	1.51
304.72	1.21	145.831	145.646	-0.18	1.39
304.77	2.03	145.884	145.708	-0.18	2.21
304.95	2.64	146.061	145.911	-0.15	2.79
304.98	1.88	146.092	145.946	-0.15	2.03
305.12	0.71	146.235	146.111	-0.12	0.83
305.15	0.90	146.265	146.145	-0.12	1.02
305.31	0.43	146.427	146.332	-0.10	0.53
305.35	0.48	146.467	146.377	-0.09	0.57
305.50	1.64	146.618	146.551	-0.07	1.71
305.57	1.34	146.685	146.629	-0.06	1.40
305.65	0.77	146.769	146.725	-0.04	0.81
305.89	0.88	147.006	146.997	-0.01	0.89
305.99	1.39	147.108	147.114	0.01	1.38
306.04	0.36	147.160	147.175	0.01	0.35
306.05	0.31	147.167	147.182	0.02	0.29
306.23	0.92	147.351	147.394	0.04	0.88
306.26	0.52	147.376	147.423	0.05	0.47
306.35	0.86	147.470	147.531	0.06	0.80
306.53	0.85	147.651	147.739	0.09	0.76
306.63	0.58	147.747	147.849	0.10	0.48
306.68	0.33	147.799	147.910	0.11	0.22
306.82	0.72	147.942	148.073	0.13	0.59
306.85	0.60	147.970	148.106	0.14	0.46
307.02	2.61	148.135	148.295	0.16	2.45
307.06	2.35	148.181	148.348	0.17	2.18
307.17	2.62	148.286	148.469	0.18	2.44

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
307.27	3.01	148.386	148.584	0.20	2.81
307.42	1.19	148.545	148.767	0.22	0.97
307.52	1.29	148.643	148.879	0.24	1.05
307.56	1.27	148.680	148.922	0.24	1.03
307.65	0.35	148.773	149.029	0.26	0.09
307.77	1.03	148.893	149.167	0.27	0.76
307.90	0.92	149.021	149.314	0.29	0.63
308.04	1.22	149.159	149.473	0.31	0.91
308.13	2.16	149.256	149.584	0.33	1.83
308.18	1.43	149.304	149.639	0.34	1.09
308.31	0.60	149.436	149.791	0.36	0.24
308.35	0.98	149.477	149.838	0.36	0.62
308.50	1.99	149.622	150.006	0.38	1.61
308.55	1.94	149.677	150.068	0.39	1.55
308.66	0.38	149.786	150.194	0.41	0.00
308.80	1.04	149.927	150.356	0.43	0.61
308.87	0.74	150.000	150.440	0.44	0.30
308.98	0.81	150.000	150.440	0.44	0.37
309.11	1.11	150.000	150.440	0.44	0.67
309.19	1.68	150.000	150.440	0.44	1.24
309.27	1.20	150.000	150.440	0.44	0.76
309.35	0.81	150.000	150.440	0.44	0.37
309.44	0.38	150.000	150.440	0.44	0.00
309.51	0.58	150.000	150.440	0.44	0.14
309.56	0.93	150.000	150.440	0.44	0.49
309.67	0.50	150.000	150.440	0.44	0.06
309.81	4.72	150.000	150.440	0.44	4.28
309.86	6.93	150.000	150.440	0.44	6.49
310.05	7.63	150.000	150.440	0.44	7.19

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
310.06	7.86	150.000	150.440	0.44	7.42
310.23	2.00	150.000	150.440	0.44	1.56
310.26	0.95	150.000	150.440	0.44	0.51
310.44	1.41	150.000	150.440	0.44	0.97
310.50	0.29	150.000	150.440	0.44	0.00
310.55	0.77	150.000	150.440	0.44	0.33
310.57	1.42	150.000	150.440	0.44	0.98
310.71	6.21	150.000	150.440	0.44	5.77
310.75	2.69	150.000	150.440	0.44	2.25
310.93	4.33	150.000	150.440	0.44	3.89
310.98	3.48	150.000	150.440	0.44	3.04
311.14	0.77	150.000	150.440	0.44	0.33
311.18	0.67	150.000	150.440	0.44	0.23
311.22	0.86	150.000	150.440	0.44	0.42
311.26	0.84	150.000	150.440	0.44	0.40
311.43	3.21	150.000	150.440	0.44	2.77
311.46	5.89	150.000	150.440	0.44	5.45
311.65	1.23	150.000	150.440	0.44	0.79
311.69	1.20	150.000	150.440	0.44	0.76
311.83	0.00	150.000	150.440	0.44	0.00
311.86	0.00	150.000	150.440	0.44	0.00
312.02	0.00	150.000	150.440	0.44	0.00
312.07	0.00	150.000	150.440	0.44	0.00
312.25	0.00	150.000	150.440	0.44	0.00
312.29	0.00	150.000	150.440	0.44	0.00
312.42	0.00	150.000	150.440	0.44	0.00
312.43	0.00	150.000	150.440	0.44	0.00
312.47	0.00	150.000	150.440	0.44	0.00
312.64	0.00	150.000	150.440	0.44	0.00

Chainage (Km)	Raw Depth (m)	CD/SD w.r.t MSL (m)	Observed W.L. w.r.t MSL (m)	Reduction in soundings (m)	Reduced Depth (m)
	A	B	C	D = C - B	E = A-D
312.67	0.00	150.000	150.440	0.44	0.00
312.79	0.00	150.000	150.440	0.44	0.00
312.88	0.00	150.000	150.440	0.44	0.00
313.04	0.25	150.000	150.440	0.44	0.00
313.07	0.73	150.000	150.440	0.44	0.29
313.26	0.76	150.000	150.440	0.44	0.32
313.43	1.96	150.000	150.440	0.44	1.52
313.50	1.59	150.000	150.440	0.44	1.15
313.58	0.65	150.000	150.440	0.44	0.21
313.66	0.37	150.000	150.440	0.44	0.00
313.73	1.77	150.000	150.440	0.44	1.33
313.79	2.44	150.000	150.440	0.44	2.00
313.84	10.22	150.000	150.440	0.44	9.78
313.88	7.16	150.000	150.440	0.44	6.72
313.97	1.28	150.000	150.440	0.44	0.84
314.08	2.49	150.000	150.440	0.44	2.05
314.20	1.04	150.000	150.440	0.44	0.60
314.34	1.30	150.000	150.440	0.44	0.86
314.41	0.44	150.000	150.440	0.44	0.00
314.42	0.00	150.000	150.440	0.44	0.00

Annexure 4: Photographs along Subarnrekha Waterway

SURVEY BOAT PREPARATION

LEVEL TRANSFER AT JAMSHEDPUR

BOAT MOBILIZATION AT CHANDRABALI

BOAT MOBILIZATION AT ADIMPUR

TIDE POLE ERECTED AT SONAKANIA

TIDE POLE ERECTED IN WATERWAY

MANIKUI BRIDGE CHAINAGE 12 km

MANIKUI RAILWAY BRIDGE CHAINAGE 12.5

MANGO DAM CHAINAGE 34.5 km

PURUBHAT DAM CHAINAGE 49 km

DIGRI BARRAGE AT CHAINAGE 75 KM

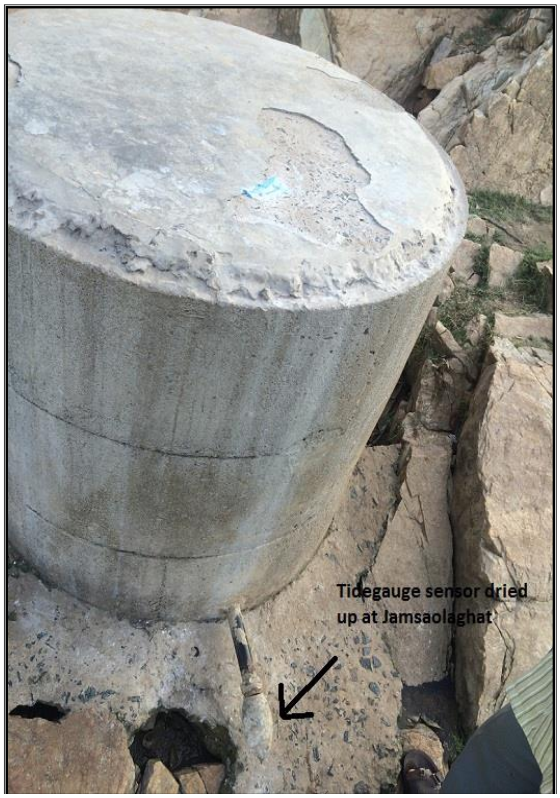
ROCKY AREA NEAR CHABISHA CHAINAGE 94 KM

DEDANG BRIDGE AT CHAINAGE 101 km

DRY PATCH ON SURVEY ROUTE CHAINAGE 102.5 km

MAJOR ROAD BRIDGE BINDA CHAINAGE 107 KM

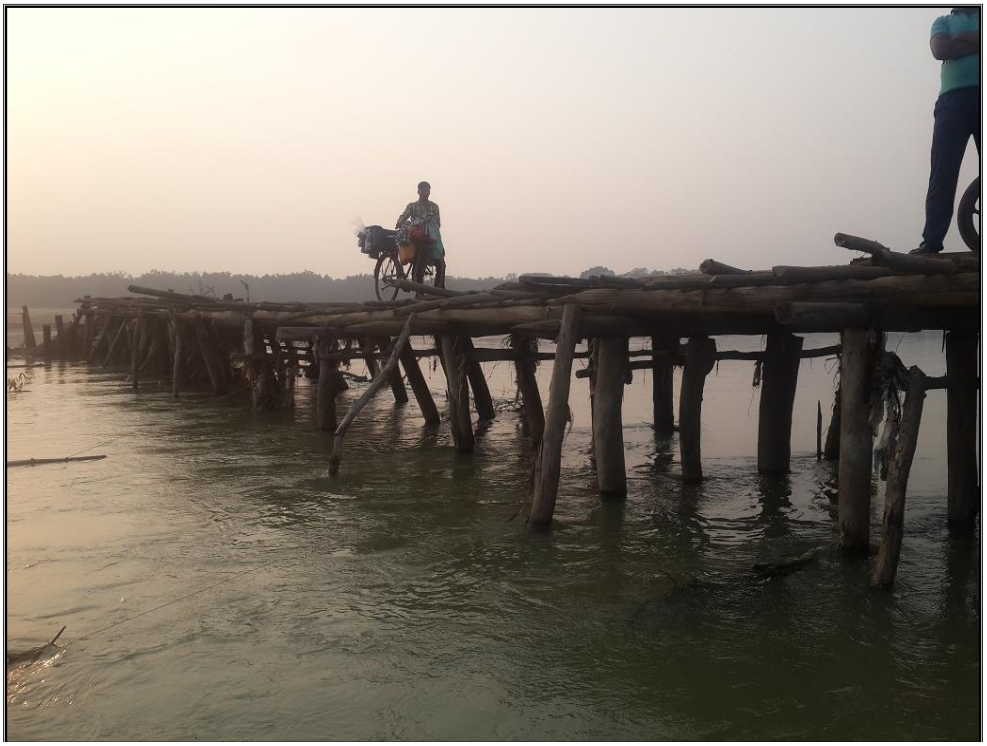
JAMSHOLA BRIDGE CHAINAGE 145 KM



CWC TIDE GUAGE JAMSHOLA CHAINAGE 145 km

ROCKY AREA NEAR GARGARIA CHAINAGE 149 KM

MANUAL TOWING THE BOAT NEAR CHAINAGE 195 KM



WOODEN BRIDGE PHULBONI CHAINAGE 208 KM

BASRA GHAT BRIDGE AT CHAINAGE 216.6 KM

MAJOR BRIDGE UNDER CONSTUCTION AT BHASRA GHAT CHAINAGE 217 KM

WOODEN BRIDGE AT CHAINAGE-243 KM SONAKANIA

CONSTRUCTION OF BREAKWATER MAKRAMPUR CHAINAGE 246 KM

WOODEN BRIDGE PATNA CHAINAGE 258 KM

RAJGHAT RAIL BRIDGE CHAINAGE 262 KM

KATHAPAL MAJOR ROAD BRIDGE CHAINAGE 286 KM

BREAKWATER BISHNUPER CHAINAGE 291 KM

FERRY SERVICE AT CHANDRABALI CHAINAGE 312 KM